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Dimensions of Access to Traceability Information for US Beef Cattle Producers: Merging Information Frameworks for Assessment and Visualization of State Web-Based Resources in an Effort to Strengthen National Security Connections between Government and Cattle Farming Operations

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To the Graduate Council:

I am submitting herewith a dissertation written by Reid Isaac Boehm entitled "Dimensions of Access to Traceability Information for US Beef Cattle Producers: Merging Information Frameworks for Assessment and Visualization of State Web-Based Resources in an Effort to Strengthen National Security Connections between Government and Cattle Farming Operations." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Information Sciences.

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ABSTRACT

US consumers eat a lot of beef. The nation's beef cattle production industry is a multi-faceted, complex supply chain which makes it an area rich for discussion about information practices, yet vulnerable to problems such as disease and terrorist attack. This research looks at cattle identification and traceability information resources that are accessible to beef cattle producers through two web channels: the state cooperative Extension website and the state Department of Agriculture website. This is a state by state content analysis of all fifty states to look at the topics, types, formats, quality, and interactivity of the available resources. By merging two information frameworks, one with theoretical attention to components of access to information and one with applied attention to government information valuation measures, the research demonstrates an analysis process that connects state cattle producer demographics for comparison with aspects of the available cattle identification and traceability information from that state. This includes visualizing the nation as a whole and comparing state-based similarities and differences, illuminating areas of strengths, weaknesses, and gaps in contextually congruent information for the producer and stakeholder populations.

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CHAPTER 1 - INTRODUCTION

Vulnerability in Our National Food Supply

US consumers eat a lot of beef. The total amount of beef consumption in the United States in 2013 was about 25.5 billion pounds, a majority of which comes from the approximately 729,000 beef cattle operations in the US (NCBA, 2014). The phased production of cattle through the beef supply chain connects farmers and industry workers to retail and consumers nation-wide. Imagine for a second how a single instance of infection to a herd could spread a disease and the impact of such an outbreak. Infectious diseases are spread to other cattle through manure, saliva, blood, urine, or in some cases through the air (Hopkins, Welborn, & Palmer, 2006). Additionally, 75 percent of new infectious human diseases are of animal origin and 60 percent of human pathogens are communicable between species to other animal populations (IIAD, 2014). Now imagine what a terrorist group with access to a pathogen and a herd could do, not only to the food supply of the nation, but to the livelihoods, and potentially the lives of the American people. Agroterrorism is not a new threat; livestock were considered targets as early as the First World War (Yeh, Park, Cho, & Cho, 2012). The sobering reality that it could happen in the future is heightened by multiple instances of terrorist acts throughout the country and abroad. The food supply is just as much at risk as the runners in the Boston Marathon were in the spring of 2013 or the passengers in flight with the shoe bomber in the winter of 2009.

The nation has and is taking multiple steps to interagency collaboration to safeguard beef operations to the potential threat of disease outbreaks, yet as a nation we lack the type of federal traceability system that most developed nations employ, which means there are two avenues of vulnerability in beef industry communications in biosecurity at a national level. First, in prevention and detection of an outbreak, it is difficult to identify areas of weakness and to have a clear picture of the identification practices of producers distributed throughout the country. Second, in the occurrence of an outbreak; mitigation, response and recovery are substantially hindered with no way of knowing exactly where an infected animal has been and with whom that animal has been in contact. Lack of standard practices means longer response times, costly quarantining procedures, and greater destruction of cattle that may or may not be infected (Rawls & McKinley, 2005).

Full traceability may not be applicable at the national scale at this time for the majority of producers in the country; however, developing a holistic understanding of cattle identification and traceability information communicated at the state level is essential to understanding the national picture of cattle identification and traceability practices and to addressing potential biosecurity risks to the cattle industry head on. This holistic picture is important because it gives food security officials a resource to access the knowledge within the complex state-based network of practices in the event of an outbreak. Additionally it allows a view of the differences in access to information among distributed, heterogeneous groups of cattle producers in the interest of

strengthening components of the biosecurity communication infrastructure across the nation.

Differentiating Concepts of Identification and Traceability

The practice of cattle identification can be something as simple as a distinguishing hide marking or as complex as a Radio Frequency Identification (RFID) tag that is scanned and connects to records of individual characteristics, health history, and location-based information as part of a database of information about the herd. Throughout history, cattle producers have used myriad ways to identify their herds or individual cattle at different times depending on the circumstances with which they need to employ identifying measures (Caja, Ghirardi, Hernández-Jover, & Garín, 2004). For example, at the turn of the 19th century in the US, bovine tuberculosis was a large concern for the cattle industry and health inspectors relied heavily on identification practices in specific areas to mitigate the spread of the disease (National Academies Press, 1994). In other instances, ranchers need to be able to identify members of their herd and deter theft. Cattle auction operations often use a temporary means of identification in the form of a back tag for the purposes of efficient sales process. Some identification systems have the ability to be traceable, and others are purely for use in one operation.

Traceability systems are integral to national and international beef supply chains because they provide a method to track back a disease to the source of the outbreak (Smith, Tatum, Belk, Scanga, Grandin, & Sofos, 2005). Additionally, locations with which

the cattle change hands will be a part of the records. Emergency response professionals are able to quickly go straight to the sources. Without the traceability component within the affected supply chain, massive amounts of quarantining and animal testing must be implemented and can lead to significant, unnecessary disruption and loss for individual producers and the market as a whole (Rawls & McKinley, 2005).

Motivating Factors for Implementation

In recent decades there are multiple instances globally where countries suffered as a result of disease outbreaks in cattle and other livestock. For example, in 2001, the United Kingdom experienced the devastating effects of an outbreak of foot and mouth disease (FMD). Millions of animals were destroyed, billions of dollars were lost, and farmers suffered catastrophic situations as a result. Cases of disease outbreak such as this, as well as the international demand for and trade of beef, have motivated countries to implement national identification system regulations. Many nations such as Canada, Japan, Europe, and Australia have national identification systems or are in the implementation process (Rawls & McKinley, 2005; Smith et al., 2005). The major factor driving the need for these systems is enhanced disease control and eradication among all sectors of the beef supply chain. After the September 11th 2001 bombing of the World Trade Center and further instances of attack from terrorist factions on both US soil and abroad, the notion of agroterrorism increasing became a prime motivator behind discussions and plans to take steps to safeguard the beef industry in the US from disease outbreaks (Anderson, 2010).

In the events leading up to the final ruling on the National Animal Identification System (NAIS) in the US in 2013, the role of information in cattle identification and traceability systems was notably an integral yet problematic component to development and proper understanding of the needs of all members within the beef cattle supply chain (Rawls & McKinley, 2005). Traceability is seen as one way to facilitate the transfer of information and the communication between the diverse sectors of the supply chain. The unique situation of the beef cattle supply chain in the US means that communication and information about cattle identification and traceability options, costs, and benefits, as well as delineating specific needs of underrepresented communities is incredibly complex. So complex, in fact, that traceability is almost impossible to implement at this time (Ringwall, 2007).

Communication Barriers to Implementation

In 2003, following an instance of Bovine Spongiform Encephalopathy (BSE) in the US, as well as other past instances in surrounding areas, the US began phased implementation of a national animal identification system (NAIS) to regulate the identification and traceability of livestock. In the first ten years following the original proposal, the NAIS developed into a comprehensive, voluntary traceability plan with future goals to become mandatory. Prior to these proposed regulations the use cases of identification and traceability were mainly employed in reaction to diseases and had ultimately eradicated a lot of disease; however, this means that some cattle producers

no longer vaccinate or tag their herds and trace back in many instances can be near to impossible (Radke, 2011).

Multiple barriers exist to executing the previously proposed federal system such as crippling costs for farmers in relationship to the perceived benefits, as well as fears of liability, and breach of privacy (Anderson, 2010; Bailey, 2007; McBride & Matthews 2011; Schulz & Tonsor, 2010). Many producers throughout the country continue to voice grave concerns about such regulations. As a result of these concerns the government gave a final ruling in 2013 to implement a flexible, less burdensome plan with minimal requirements. An excerpt of the final ruling is available in the appendix A.1. The ruling allows for states and tribes to develop beyond the minimal federal stipulations, and retain guidelines or regulations that work best for the producers within the state (APHIS, 2014).

Each state has the ultimate power in regulation and management of cattle identification and traceability, and each state has developed practices and information resources for producers and stakeholders that serve the purposes of their population. In the event of an attack or an outbreak, these information resources and practices will need to be understood on the national level in order to properly trace the path of the cattle back to the initial source of infection with as minimal damage as possible. Additionally, understanding the accessibility of the information resources for each state's producers will help to draw out gaps in information that is available in specific

states. Knowledge of the location of information gaps and taking steps to bridge such gaps will ease the flow of information to different communities in an effective manner.

Defining Target Populations

In Verbeke's (2005) discussion of case studies on the beef industry and information asymmetry in relation to traceability he says, "Information is likely to be effective only when it addresses specific information needs and can be processed and used by its target audience" (p. 348). In studying the content of the state's cooperative Extension information resources and the state Department of Agriculture's information resources, the research defines the two major populations involved as primary stakeholders in the interest of maintaining the security of the beef cattle industry: beef cattle producers and federal government officials involved in food security.

Beef Cattle Producer Perspectives

To say that the population of beef cattle producers in the US is diverse would be a massive understatement. Historical, cultural, regional, and socioeconomic differences as well as the producer's roles and associated activities within the supply chain make it impossible to generalize beef producers as a singular entity. The majority of US farms, roughly 80 percent of about 2.2 million, are small scale farms and this is particularly the case for beef cattle operations. Small scale cow-calf operations make up about 35 percent of all farms and 80 percent of these farms have fewer than 50 cows (McBride & Matthews, 2011).

Along with the scale of operation and profits, distinctions between beef cattle operations also include characteristics outside of mainstream agriculture such as conditions for ethnic minority farmers, those with limited resources, producers who utilize non-traditional avenues of sale (e.g.: direct to consumer) and those who do not monocrop (Dawson, 2011). Producers are also classified according to three phases of commercial production: cow-calf producers, stockers, and feedlot operations, which will each add specific viewpoints and information needs to their understanding of the situation. (Dawson, 2011). Producers are also classified according to three phases of commercial production: cow-calf producers, stockers, and feedlot operations, which will each add specific viewpoints and information needs to their understanding of the situation.

Additionally these phases of production are more conducive to certain regions of the country and are dispersed according to the nature of the environment within a region, as well as according to historical practices that developed along with the rise of cross country rail transit, and in response to political and industrial conditions. These considerations are often tacit structural components to the nature of the experience of these producers with national regulation. For instance, many cattlemen in the southwest have traditionally used branding out of necessity and find the use of RFID tags would not provide the same attributes that these individuals need to utilize in their ranching practices. Small scale farmers in the southeast may be struggling to maintain their profit given environmental circumstances. The additional cost of equipment could

be an unwelcome or damaging burden. Issues such as these mean that top concerns of the producers in safeguarding for and responding in the event of an outbreak or attack will be significantly different that those involved as federal government officials in mitigation and communication of that attack in the interest of the nation as a whole.

Government Security Perspectives

Federal government stakeholders have different interests driving their information needs and behaviors. Their top concerns will be that of expedient communication, detection at the source, and managing the delivery of information to sectors of the public sphere. For example, the National Response Framework outlines four goals for Homeland Security, "preventing and disrupting terrorist attacks, protecting critical infrastructure and resources, responding to and recovering quickly from incidents, and strengthening the system for long term success" (FBI, 2008, p.8). This research addresses the need to protect critical infrastructure and resources and strengthen the system of communication by assessing and mapping the distributed information resources about cattle identification and traceability, and the distributed practices that are occurring in conjunction with the context of the population of producers in each state.

Addressing Outreach and Local Knowledge

Scholars in agricultural economics note that the cow-calf production sector has the greatest need of traceability and identification and yet also poses the greatest challenge for adoption (Schulz & Tonsor, 2010). Eighty percent of the small scale cattle

producers surveyed in a 2008 national survey used an ID system of some kind; however, a fourth of these lacked familiarity with the NAIS (McBride & Matthews, 2011). One of the biggest problems in continuing to communicate about identification and traceability measures as a nation is the question of how those who are engaged in detecting, preventing, and communicating about cattle disease outbreaks and agroterrorist activity can reach out to the cattle producers in remote locations, with information needs and place-based knowledge that may be important to understanding how to best protect an area.

The Importance of the USDA as an Overarching Authoritative Resource

The USDA provides an essential service to the nation both in the research and administrative capacity with which they facilitate and oversee myriad aspects of agricultural resources across the US. Additionally, their role in communicating information and providing resources to producers and information seekers across the nation is wide reaching and takes into account the information needs of multiple populations.

The USDA has seven mission areas and each plays a specific role in the information resources available to website users. These areas include: the Farm and Foreign Agricultural Services, which address uncertainties and risk management; Food, Nutrition, and Consumer Services; Food Safety; Marketing and Regulatory Programs, which includes APHIS; Natural Resources and the Environment, which addresses sustainability and land management; Resources, Education, and Economics, which

includes multiple information entities including the Research, Education, Economics Information System (REEIS), National Agricultural Library and the National Agricultural Statistics Services; and Rural Development, which supports operations in rural areas across the US. The organization of these mission areas within the larger agency demonstrate the multi-faceted approach to providing information. In the context of this research there are multiple types of information available to producers seeking information on cattle traceability and identification. APHIS, in the Marketing and Regulatory Programs provides clarification and documentation on the final ruling for cattle traceability and Research, Education, and Economics (REE) provides the infrastructure that connects individuals with cooperative extension programs, information services, statistical assessment tools, and etcetera, that are important aids to information seekers.

This research acknowledges the existence and success of these resources as well as the unique ability of REEs programs to provide avenues to education, information, and research; however it also acknowledges that the final ruling on animal disease traceability gives states the option to enforce higher levels of regulation and request compliance from those entering their state while transporting cattle. The state websites need to have information available because of this state specific component to the ruling. Additionally, state information has an opportunity beyond the scope of federal web resources to provide information that is tailored to more specific needs of the demographics of their region. Cultural differences and regional differences can be

addressed at the state level that would be difficult at the federal level. Information seekers will look to local and state channels for regulatory information so it is important to evaluate the state's abilities to provide information and facilitate interaction within an information environment from state level websites.

One way to begin to address this is to think about major entities with which the USDA reaches out to farmers in distributed locations around the nation. Bailey (2007) acknowledges the importance of the land grant institution to continue to address market issues involved with identification, and this can be extended to consider the important role that the collaboration between the United States Department of Agriculture (USDA) and these federal land grant institutions plays in providing information resources to farmers in the communities around the nation. The cooperative Extension system is a national education network and each state or territory has an office at a land grant institution, which is connected to local and regional offices within that state (CSREES, 2014).

The USDA provides an interactive map that directs an individual to the cooperative Extension office(s) in the state of their choice. This provides one channel with which to analyze the information and services provided on cattle identification. Searching for the key terms on the state websites allow the researcher to systematically gather the available information in the same way a state visitor to the website might. In conjunction with this channel, each state Department of Agriculture also offers information about cattle identification. Links to each state's department of agriculture

are provided through the USDA Risk Management Agency webpage. Accessing each of these websites and related information resources provide two state based channels of state specific information about cattle identification and traceability.

Conceptualizing Access to Information

The concept of access to information in information science scholarship comprises not only having the technology needed to receive the information that is put forth, it also recognizes the other integral components of knowledge, communication, control, goods and commodities, and participatory capabilities, as well as context-based components of the information seeking environment (McCreadie & Rice, 1999 a). Employing such an understanding of the information about cattle identification and traceability across the nation through a framework that considers these dimensions in a holistic manner allows for the research to address concepts of equity and information gaps that previous studies of cattle identification and traceability in the US have brought to the fore. The research extends scholarship in the study of food safety and agriculture by forging connections with information science and systems research. Additionally, it adds to the field of information science by using a unique combination of qualitative and quantitative methods in an applied manner and by testing and further crystallizing a theoretical framework for use in a complex information environment.

This research explores the information resources using the framework set forth by McCreadie and Rice in 1999 as a synthesis of dimensions of access to information. The framework is suited to the study of a complex problem, such as the evaluation of

distributed information resources in the desire to strengthen communication networks, for multiple reasons. First, it addresses dimensions of access on a continuum between theory and practice, which acknowledges that some factors of access may be more integral to the actions of stakeholders engaged in the process of relating with information than in the scholarly activity of theory construction. Some information dimensions are more tightly entwined with the needs of the stakeholder, while others can be evaluated based more on empirical dimensions of scholarship.

Additionally, this framework allows for examination of the multiple perspectives of both government officials and cattle producers as they engage with the information. McCreadie and Rice (1999 b) characterize the framework existing as, "access environments (that) are analogous to Taylor's information use environments" (p.93). Taylor (1991) characterizes his Information Use Environments (IUEs) as the group of components that affect the transmission and movement of information between communicators. The IUE provides the grounds in which to assess their quality. Thus, the relationships between the diverse perspectives are preserved within an evaluative space as a complex whole.

Visualizing Communication Networks

The concept of the existence of an environment with which communication and information behaviors occur is important to overall understanding of the network of individuals involved. Once each state's content is analyzed, further comparison can occur among the states. Network analysis seeks to shed light on the patterns of

communication among people or organizations (Freeman, 2014). Analysis of shared information, resources, management practices, and communication as ties between official organizational structures such as the cooperative Extension offices and the state departments can illuminate patterns of strengths, weaknesses, and unique opportunities for future consideration. This network analysis process also serves to visually map perspectives based on what is observed from those multiple locations. It provides insight on how we can navigate further connections in the interest of developing mutual understandings about accessible, equitable information in the interest of communicating and responding in the event of an outbreak or attack on the national industry.

Embracing Transdisciplinarity

In the research we are looking at dimensions of the information that is available in consideration of the context with which it is managed, disseminated, and accessed. The research design takes a transdisciplinary approach to inquiry because it acknowledges a need for standardized measures to ensure national compatibility in the event of an outbreak or attack, yet at the same time acknowledges the context based needs of the diverse national population of beef cattle producers. Broad apriori definitions are important in this case to understand better the nature of what is currently available in each situation across the states and to set the boundaries in which to apply elements of context conceived in previous research from multiple disciplines. This will ultimately lead to illumination of context-based gaps.

Ontologically, the research recognizes that realities are individual constructions, yet addresses the need to create shared understandings of concrete measures to facilitate effective action towards best serving the needs of the populations involved in the beef cattle industry. Epistemologically, the relationship between the knower and the object of study (the information resources) are rooted in the give and take between the direct observations of the knower with the information and the nuances gained through context dependent demographic and socio-cultural scholarship of other disciplines that can highlight the knowledge of the other populations. Additionally the research acknowledges the value-ladenness of the inquiry in every definition and parameter set. The application of a mixed method analysis that uses both qualitative and quantitative measures addresses this by delineating multiple value structures in an effort to assess and highlight those incongruences.

The Research Questions

This research takes into consideration potential vulnerabilities of the national beef cattle industry in the event of an outbreak of foreign animal disease or agroterrorist attack and seeks to preserve the security of one of the largest sectors of US food production in the nation. Given the understanding of the diverse population of beef cattle producers distributed throughout the nation, the research provides an approach to assessing the strength and equity of one communication and information access network. This first chapter outlines the importance of studying cattle identification and traceability information access in the interest of national security.

Chapter 2 provides an in depth review of the literature on the topics of livestock identification and traceability, the demographics and diverse needs of the national beef cattle industry, scholarship on access to information, information seeking behavior, and government information. Chapter 3 introduces the CIAV framework which is created from the combination of two information science theoretical frameworks. Then chapter 4 outlines in detail the methods used to answer the following four research questions:

1. **Information Resources:** What beef cattle identification and traceability information resources are accessible to producers and other information seekers for each state in the US?
2. **Equity of Access:** In conjunction with the demographic, economic, and legislative diversity at the state level in the US, is there equity in the accessibility of beef cattle identification and traceability information for producers?
3. **Gap Analysis:** Where are the gaps, strengths, and weaknesses in accessible identification and traceability information communication channels between the federal government, external state, national, and international resources and each state's beef cattle producers?
4. **Overall Performance:** Out of all 50 states, which states have the highest level of overall performance in providing equitable access to resources on beef cattle identification and traceability for the producers and other stakeholders of the state?

CHAPTER 2 - LITERATURE REVIEW

The threat of disease in the nation's cattle industry whether from outbreak or attack is an area of concern for multiple disciplines of study just as it is a concern that affects the multitude of diverse members of the national and global populations. Communicating information in the interest of biosecurity of the food supply means understanding the current scholarship from multiple domains: from agricultural economics to information science and systems research. In chapter 2 the research delves into past scholarship surrounding the dimensions of cattle identification and traceability issues in the US and sets the stage for the current research design. Chapter 1 introduced the significant issues at hand that drive the design of the research and chapter 3 will explain the new framework for analysis, the CIAV model, which will structure the research design. Then chapter 4 will lay out the process that the researcher will take to answer the four research questions that arise from the discussion of these significant issues to the cattle industry and the nation at large.

Agroterrorism Studies

An especially poignant fact brought up more than once in the scholarship on agroterrorism is that; "a pound of meat travels about 1000 miles on the hoof before it reaches the dinner table" (Wilson, Logan-Henfrey, Weller, & Kellman, 2000, p. 41). This thought characterizes the factors of vulnerability that are discussed in varying depths throughout the literature. Agroterrorism research discusses a fairly standard definition of the term as an instance of a deliberate attack on an agricultural system by

introducing damaging biological agents with the intent to do harm (Boone, Boone, Ours, & Woloshuk, 2011; Breeze, 2004; Keremidis et al., 2013; Schneider, Schneider, Webb, & Hubbard, 2011). Bioterrorism is a closely related term that is used to talk about the use of these harmful biological agents in a pointed attack that extends beyond the agricultural system and into domestic and public systems (Schneider et al., 2011; Yeh et al., 2012). These harmful biological agents can be toxins and microorganisms or viruses and bacteria such as Foot and Mouth disease (FMD) and Bovine Spongiform Encephalopathy (BSE), to name a few of the insidious foreign animal diseases (FADs) that are often spoken about as grave threats to the livestock industry (Breeze, 2004; Dixon, 2013; Dykes, 2010).

In conjunction with these definitions of threats to the food supply, the terms food security and biosecurity reflect the nation's ability to both drive away and prevent the instance of an attack or an outbreak, or the ability with which the nation can effectively act and recover in the face of infection (Foxwell, 2001). Discussion of national levels of biosecurity and food security is reflected in the myriad dimensions of vulnerability that are outlined in agro and bioterrorism research. Several commonly discussed factors of vulnerability include: the amount of potential supply chain entry points for biological agents and the vertical integration or concentration of practices in the agricultural industry (Cupp, Walker, & Hillison, 2004; Elbers & Knuttson, 2013; Monke, 2006). Additionally the majority of diseases continue to survive and thrive in the environment, are easy to obtain, and easy to release (Elbers & Knuttson, 2013; Yeh et

al., 2012). Remoteness of locations, increased global transportation of people and animals, and the silent nature with which a disease appears are also hindrances to maintaining high levels of food security (Dixon, 2013; Dykes, 2010; Yeh et al., 2012).

While most of the research focuses on the attack of terrorists and biological warfare specifically, certain scholars note that it may be hard to distinguish whether an outbreak is a FAD or an intentional attack. Elbers and Knuttson (2013) focus on differentiating between an outbreak and an attack and Yeh et al. (2012) notes that it is difficult to determine when studying past foreign government activities whether a disease is examined and kept for peaceful or malicious purposes because there is generally not going to be any significant weapons created. Whether the outbreak is intentional or natural, the resulting impacts are the same and scholars address the multi-faceted blows to the nation as a result. Cupp et al. (2004) state, “Even the rumor of disease can produce sudden damaging consequences to the market economy” (p. 100). Schneider et al. (2011) discuss the economic toll (billions of dollars every year) that livestock and disease pathogens already take. Yeh et al. (2012) mentions this as one goal of agroterrorism along with the psychosocial and fear-generating mechanisms behind disease outbreak. Breeze (2004) addresses the psychosocial aspect of response tactics in particular the issue of mass slaughter.

One of the main themes throughout the biosecurity and agroterrorism literature is an attention to historical accounts. Keremidis et al. (2013) looks at four past politically motivated cases of terrorism defining categories of terrorist activities and Yeh et al.

(2012) looks at past instances where developed nations were actively developing biological weapons. Elbers and Knuttson (2013) look at the economic costs of past outbreaks. The most reported upon disease in the literature is FMD (Breeze, 2004; Dixon, 2013; Dykes, 2010; McClaskey, 2014) and for just cause. First, the images and outcomes of the recent FMD outbreak in the UK in 2001 remain etched in the minds of people around the globe, and second, given the properties of such a disease, experts have estimated severe consequences should FMD enter the livestock industry in the US (Breeze, 2004; Dixon, 2013; Dykes, 2010; McClaskey, 2014).

With the discussion of FMD and the threat of an outbreak of a disease, the majority of the literature focuses on response plans and gaps in communication. McClaskey (2014) looks at dimensions of policy, taking a multi-disciplinary approach to addressing problems of mass euthanasia, carcass disposal, and vaccination; while Dixon (2013) focuses on decision support for multi-stakeholder partnerships. Cupp et al. (2004) in recommendations for the future, stresses the sharing of information by providing an example of two information systems that were both charged with gathering information, but neither linked to share the information with the other or with related databases. Breeze (2004) delineates five characteristics for patterns of events during an epidemic outbreak, which ultimately lead to his definition of command, control, and communicate systems. The literature seems to be in agreement that information is a significant and necessary factor in the prevention and response tactics and that the systems and populations that need this information are complex

and often at odds or disconnected. Even so, there are some components of this concept that have yet to fully develop.

It is interesting to note that the majority of the scholars talk pointedly about both the problem of concentration of practices, for example McClaskey (2014) mentions that over half of the beef cattle are finished within a small circumference of about two hundred miles and that nationally the majority of grain-fed cattle filter into a small number of feedlots. This may certainly be true, yet another problematic factor is the remoteness of operations, especially in the cow calf production phase. These lesser known opposing spaces involved in production are potentially problematic because this is where information and communication are least available. The lack of attention may carry the highest level of vulnerability. For example Wilson et al. (2000) look at selection criteria for biological weapons, specifically looking at animal agriculture. They stress that auction and sale barns may present as perfect locations.

In another example, Breeze (2004) is vehemently persuasive in his position that as a nation we have the technological expertise to implement better prevention and response tactics; yet he leaves out the perceived cost and practical factors related to implementation of certain technologies such as a national traceability system. This article is a prime example of the sentiments leading up to the final ruling on the NAIS and is still reflected in the recent policy and planning writing surrounding agroterrorism. Complexity and multiple-stake holding entities are taken into consideration, yet there is still little focus on the beef cattle producer communities and there are seldom studies to

take into account the information practices, perspectives, and characteristics of those who are identified as vulnerable populations (Wilson, et al., 2000).

Boone et al. (2011) is an example of a study looking at beef cattle producer perceptions in West Virginia. The authors found that the majority of the producers felt that they were not prepared for the instance of an attack. The study recommends that more information on biosecurity should be available in a channel and format suited to the populations. Studies such as these dealing with agroterrorism carve out a space for information professionals to bridge gaps in communication channels. With vulnerability and communication development supported as major concerns, this research plans to discuss how channels of information dissemination can be evaluated and enhanced for use by multiple populations and distributed diverse user groups in the interest of understanding one large and highly contested area of biosecurity.

Cattle Identification and Traceability Research

Cattle identification is a component of traceability systems. Yet some identification practices are more temporary than traceable, such as back tags; or more location and producer specific, such as a brand to establish ownership. There are multiple factors that go into what a producer chooses to use. For example, Hamilton-Maude (2014) explains that freeze branding is popular among ranchers because it looks sharp and stands out against the black or red hide. The ranchers can keep their breeding records right on the cow. She also mentions factors such as a hot climate or a less conditioned cow that might make it a less effective choice for everyone.

Traceability is a much more complicated component to the overall practice of verifying status of the animal or a group of animals as it requires both the identification of the livestock from their birth plus the ability to track and record movements and treatments the animals go through in their life span until processed for consumption (Smith et al., 2007). A majority of the developed countries are using traceability on a national scale in order to safeguard against or respond to disease transmission and in order to respond to the needs of the global market.

In looking at the literature focusing on national cattle identification and traceability, one of the interesting and perhaps problematic factors to developing an understanding of the issue as a whole is that authors come at the discussion either from the side of meat traceability and food safety or from the angle of live animal traceability (Schulz & Tonsor, 2010). It reflects the idea that while the beef cattle industry is wholly dependent on the fluctuation of the entire supply chain, there are also factors that limit the communication between entities in that chain. It is this limited communication that ultimately perpetuates both disagreements in the functions and features of identification and traceability and keeps the nation in a more vulnerable position. It is important to acknowledge that some scholars are beginning to address traceability throughout the supply chain such as in discussing genetic value (Seyoum, Adam, & Ge, 2013) or in looking at supply chain stakeholder perspectives (Crandall et al., 2013). In the case of examples such as Crandall et al. (2013); however, the livestock industry is treated as a singular entity, which as this research seeks to establish, is not the case.

There are many different types of systems designed for traceability and the characteristics of that system impact other factors such as the duration and spread of FADs as well as economic outcomes (Schulz & Tonsor, 2010). Smith et al. (2007) discusses system scope in terms of breadth, depth, and precision. Some of the main points they reiterate in conclusion are that traceability systems are diverse in their rate of development across trading partners and that the beef supply chain is usually the first product tracked. In the US there are four major motivators for producers to choose to use traceability: as protection of property, in the practice of disease control and prevention, to add value through the proof of specific market practices and attributes, and more recently to maintain confidence of consumers (Anderson, 2010; McBride & Matthews, 2011; Schulz & Tonsor, 2010).

In consideration of marketability, Bailey (2007) notes that the international perspective on creating and maintaining standards of quality and safety has created "trade frictions" and significantly lowered US status as a competitive member in the global trade of beef. At the private, state, and national levels the USDA offers value-added programs called Process Verified Programs (PVP) and Quality Assessment Programs (QVA) in which traceability is implicit (Schulz & Tonsor, 2010). These programs provide standards of practice and monitor the activities and attributes of production to address certain desired characteristics such as age, source-verified, organic, and non-hormone treated cattle (NIAA 2007). These standards are necessary for export to other countries that have strict standards regulating the beef that comes into the country.

One benefit and potential motivation noted is the ability to move into niche markets such as grass–fed and brand delivery systems that will gain a higher profit for a small section of the population (Bailey, 2007; NIAA, 2007). Another aspect is the use of the data gathered in traceability systems for the purposes of managerial decision making; however, this choice may not be as important on the small scale or in specific phases that have other determinants that direct decision making (Anderson, 2010).

Of tantamount concern is the threat of disease and the health of the beef cattle maintains a top position as a motivating factor for identification and traceability (McBride & Matthews, 2011; Schulz & Tonsor, 2010). Yet as McBride and Matthews (2011) find in their survey of beef cattle producers, risks of identification outweigh the benefits. Anderson (2010) reiterates that there are "certain costs and uncertain benefits" delineating ten criticisms and confusions that initially came up with the planning for a national system. Breiner (2007) names top concerns including: the cost to the producer, reliability of the technology, the confidentiality of the information, and the potential liability of the operation should a disease or issue be traced back to their premises. In the case of local auctions and larger operations the concern was more about cost and less about the liability (Carlberg & Hogan, 2013). One of the most often discussed concerns beyond the cost is the issue of who is going to control and have access to the data (Anderson, 2010). This is a pervasive information problem in multiple areas of society for several reasons and in this case it is tied to other concerns such as

liability, privacy, autonomy, and misinformation about exactly what the technology can and cannot do.

Traceability systems are noted for their capacity as a way that information may be more equally distributed and communicated across all points of the beef industry supply chain (Bailey, 2007), but until such time as traceability systems are utilized on the national scale, there is still an issue of information asymmetry noted among scholars to the way that information is provided to types of producers (Anderson, 2010; Bailey, 2007; Carlberg & Hogan, 2013). Multiple sources note that regional and cultural differences play a large role in how producers choose information (Jensen, English, & Menard, 2009; Radke, 2011; Richey et al., 2005). It is important that those in the practice of dissemination of information take these complex characteristics into account as they design resources to best fit specific areas and communities in the interest of cattle identification and traceability.

Defining the National Cattle Producer Population

Beef cattle production is one of the main occupations of farming operations worldwide and the national market has myriad ways to describe farming operations such as sustainable, subsistence, family-owned, organic, conventional, agribusinesses, and many others. Farmers are often grouped according to the activities or cultures of work that define their production (Vanclay, 2004). Media reports often focus on agribusiness, and agricultural development often centers on efficiency and effectiveness of large-scale operations in addition to operational policy-related practices, for instance:

land mapping, livestock tagging, and market labeling (Davidova et al., 2013). Agribusiness was initially defined by Davis and Goldberg (1957) as all of the operations involved in the processing, manufacturing, and distribution of farm supplies, as well as on farm operations, processing, and distribution of the resulting commodities; yet, it became a term for distinguishing big business operations from smaller endeavors that may be more specialized or that provide products to larger markets for distribution.

The role of the small scale farmer is an equal component in relation with agribusiness in the production of food and services in the United States. Blogger and communications coordinator for *Small Farm News*, Brenda Dawson asks, "So, what is a small farmer?" She discusses that popular ways about thinking about the small scale have to do with such identifiers as the number of acres, ownership type, and profitability level. "When we talk about small scale farmers," she says, "we frequently mean those farmers who cannot compete on low prices alone" (Dawson, 2011, p.1). That means they have to seek outlets to promote their product, connect with chains of distribution, and highlight the specialties, niches, and benefits to their operation over the larger ones.

Among the American public it is not well known that the number of small scale farms in the country account for 87.7 percent of *all* farms and less than three percent of sales (NASS, 2012). This most recent census count uses the definitions designated by the USDA Economic Research Service (ERS) and the National Commission on Small Farms, which sets the boundary between large and small as being those farms whose annual

sales is less than 250,000 dollars (Extension, 2013). Nationally there are about 729,000 cattle producing operations, which is about 35 percent of all farms and about 80 percent of these producers have fewer than 50 cows (McBride & Matthews, 2011). There are a lot of producers who get by on very little thus the majority of the focus in defining the population in this research is on the small scale.

One of the important characteristics of beef cattle production is the three phases in the commercial production of beef cattle. First, the cow-calf producer focuses on the breeding, gestation and birth to weaning of the calves from about six to nine months when they are about 400 pounds. From there the stocker focuses on cattle grazing where they gain an additional 200 to 400 pounds for approximately three to eight months, and then the cattle go to the feedlot where they are fed usually with a mixture of forage and grain until they are ready to be slaughtered at 1000 to 1500 pounds. In McBride and Matthew's (2011) survey of US cow-calf producers in 2008, they found that, of those producers who were mainly cow-calf producers, the 60 percent who sold their calves at or shortly after weaning were generally located in the southeast and southern plains. Many of these farms seek outside work as a primary source of income.

Because of this income disparity and dependence on the availability of forage for the cattle, those in the south and southeast regions will be especially concerned about the costs of implementation of animal identification (Anderson, 2010; Schulz & Tonsor, 2010). The primary intersection for producers in this region with trade markets will generally be at the auction market and will most likely be focused on providing what is

required of them to make their sales at the auction swift and profitable. In the past, research suggests that those involved in managing the auction markets are less receptive to the processes of cattle identification and traceability systems due to the cost and time factor. The technology does not proceed with the same speed as the commerce at the auction (Breiner, 2007).

Often there are perceived benefits to expanding operations for producers at the small scale, yet there are limitations of land, resources, and time. Information these producers use must be sensitive to the aspect that they are also at the mercy of the season, extreme weather fluctuations, and other unpredictable aspects of the land. Rawls and McKinley (2005) provide an example of the essential materials in their presentation that reflect the sentiment that producers have multiple concerns beyond the traceability system. In their presentation about the past NAIS system prepared for local cattle producers in east Tennessee, the main things they stress are, how much is needed to comply, where to register, what are the minimal costs, and how does this change the practices that I am currently dealing with? These components of practical application are often the first and foremost in the interest of time and effort given the producer may be splitting time between external work and farm duties.

Larger operations are spread out more over the regions and generally located with greater frequency in the northern and western plains. In these areas, practices and roles within the supply chain are more diverse. The production may center on more than one phase such as the stocker and feedlot, or all three phases might happen on

one farm (McBride & Matthews, 2011). In this case it may be that producers need more information about how identification and traceability function between their levels of operation. Anderson (2010), Bailey (2007), and Schulz and Tonsor (2010) all note a difference between the perceptions of the producers involved in cow-calf only markets and those in the larger operations, especially those in the feedlot phase of production. In this case, they use information about potential export markets and the value of tracing for verified characteristics such as age, non-hormone treated cattle, home-raised, specific breeding characteristics, etc. (Bailey, 2007). This information is also important to the cow-calf producers, yet it is not necessarily perceived as a top priority when thinking about the economic feasibility of their operation. These producers will also utilize basic practical information such as, complying with regulations and etc.

Studies have already seen regional difference in the perceptions of producers about animal identification and how they access animal health information, including familiarity with the programs in general. Jensen et al. (2009) suggest from their findings that Extension resources may be most beneficial to those beef cattle producers in the more rural areas. The research also found that in 2006, only nineteen percent of the beef cattle producers that were surveyed in Tennessee were using Internet resources. This is a poignant amount when compared with McBride and Matthews (2011) who found that it was one half of the producers around the country during their 2008 survey. Additionally, the 2012 US Agricultural Census reports that 70 percent of the nation's farm operations are Internet connected (NASS, 2012). This has regional implications for

the characteristics of the information resources that the producers operating in those areas would find most salient. In small scale areas the producers might need more print driven sources and other channels that can be accessed offline. Conversely, this is less of an issue in more connected, larger, and more urban areas.

Another point to note in the utilization of information resources among the diverse types of producers around the nation is their unique levels of familiarity with current regulations. McBride and Matthews (2011) found that a majority of the cattle producers surveyed were unfamiliar with the NAIS, even though 80 percent of the producers were using some sort of animal identification. In the case of regulations at the state or national level, providing information about systems would need to take into account the specifics of the centralized system discussed so that producers could be aware of essential changes that they may need to make and/or the rationale behind certain biosecurity requirements that come into play at the state level for certain situations.

Defining the Government Population

Defining the needs and perspectives of the nation's governing body may appear at first glance quite simplistic in comparison with the previous producer population discussion; however, this is because a lot of the research previously discussed in relation to agroterrorism and biosecurity upholds the perspectives of the governing bodies. In many cases, given the allocation of funds to the perceived needs of the nation, it is through research that one sees these specific viewpoints come to the fore. In

accordance with Breeze (2004) and other scholars looking at policy and planning, the importance of technological implementation for the interests of safety and security of the food supply is tantamount. Breeze (2004), Dixon (2013), Dykes (2010), and McClaskey (2014) speak of communication, control, and coordination of multiple stakeholders. Implicit here is the view that the networked coordination of a national system of identification is of great importance (Richey et al., 2005).

Health and safety of the cattle and the American people is also an important factor discussed in the literature, though the scale of the picture is quite different. One of the major factors that was initially driving the implementation plans was that proper trace back would mean less quarantining, less testing, and less disruption of the market (Rawls & McKinley, 2005). In Radke (2011) an interviewee notes that, “Over the years because of successes in government programs such as brucellosis vaccinations, (ear) tags have helped to pretty much eradicate this disease. Because of this, many have quit vaccinating and tagging these cattle, so trace back now is almost impossible” (p.1). In conjunction with veterinary medicine, Bailey & Slade (2004) note the principle role that veterinarians see a traceability system playing in the maintenance of human and animal health. Governing bodies may see the larger costs of the market due to disease and the larger benefits of greater exports, both of which usually have an indirect or unseen relationship to the producers (Anderson 2010).

Literature from government entities often focuses on the roles of the agencies and the collaboratory efforts to connect channels of information and at the same time

distribute power and tasks. Monke's (2006) Congressional report for example, discusses the 2002 Bioterrorism Preparedness Act as well as Homeland Security Presidential Directives, and public-private partnerships that coordinate information and regulatory processes of different components of the food supply chain. Henry (2012) breaks down the different regulatory roles of US agencies in food safety assurance delivering a comprehensive overview of the partnerships and processes. He notes that the regulatory scheme may be viewed as complex, yet from the security standpoint, having a single entity as an overseer might present greater vulnerability.

The government perspective is no stranger to complexity or distributed regulatory channels and one of the important considerations for information designed to meet the concerns of coordinators is that the network of contributors can be viewed and accessed within a chain of command or flow of resources. In some cases scholars are studying social media and social networks as ways to communicate and analyze biosecurity and bioterrorist preparedness efforts (Sjoberg et al., 2013). The USDA and coordinating partners have multiple channels of communication networks such as the Laboratory Response Network, the National Plant Diagnostic Network, the National Animal Health Laboratory Network, and the Food Emergency Response Network. Additionally the Extension Disaster Education Network (EDEN), is an important link between Extension experts, the USDA, and local emergency resources (Henry, 2012). This research acknowledges the integral component of EDEN in providing resources in the event of a disease outbreak or attack, yet identifies the need for understanding the

other state-based resources that are communicating about the issues of cattle identification and traceability. EDEN is already a linked resource and in this case, the research proposes to chart new paths to understanding holistically and contextually what is distributed by the states.

Information Behavior

To further grasp the process of looking at both the content and the context of information it is important to discuss the nature of studying information behavior as established by the literature. Information behavior as an area of research within information science looks at the multitude of ways in which humans relate with information. This includes the associated needs, seeking behaviors, management of information, and the practices of giving, and using to name a few (LIS wiki, n.d.). The way individuals behave can be looked at in conjunction with their interactions and involvement with the channels and resources that provide information, and scholars in information science have developed over 72 models, metatheories, theories and frameworks to analyze certain components of information behavior (Fischer, Erdelez, & McKechnie, 2005). These ways of thinking about our many relationships with information come from different perspectives of defining the role and characteristics of the concept of information. Originally the perspectives from the literature aligned more with the systems view (i.e.: the function and constructs of the system were the main thing that drove human information behavior); however, over the recent decades this perspective has shifted to a more user centric perspective (i.e.: the mental constructs of

the user based on the situation are integral to the behavior and how a system is perceived) (LIS wiki, n.d.).

Information needs, seeking, and sense-making are primary components of information behavior research. Taylor (1968) looks at needs and seeking in terms of the reference interview in the library environment identifying four levels of seeking based on different types of needs that arise. Belkin's (1980) Anomalous States of Knowledge (ASK) is a way to systematically frame an individual's experience with an information problem. Other theories such as Dervin's (1983) Sense-making and Kulthau's (1991) Information Seeking Process look more specifically at the cognitive processes and mental states of the person engaged in the act of making sense of their environment. Wilson's model of information seeking also address the importance of the process and the individual context in the definitions of his three aspects of information seeking; yet, he also asserts that the stages are less linear and more iterative (Wilson, 1999).

This research focuses on Dervin's Sense-making as it is a base for one dimension in the discussion of information access and the theoretical framework that drives the content analysis of the information resources. Sense-making is a theory in response to problems of a reification of language (Budd, 2001). Reification of language is problematic because it makes a concept concrete in its adherence to a specific meaning. When someone's view of a concept is not the same as the designer of the system that holds information on that concept, the individual will not be able to adequately get all the information that they need. There are three basic assumptions about sense-making

that connect it with such ideas of access and equity of information among a distributed, diverse population. First, Dervin (1983) states that as scholars and information professionals, individuals do have the ability to design information systems and resources that are characterized by and responsive to the needs of individuals. Additionally there is the possibility for researchers to engage in types of communication practices with individuals that can bring out the processes that will help in this design. Finally, designing methodology and methods to assess and configure equitable systems aids other scholars in continuation of this communicative study of the process. When the research asks about equitable access to information, one of the considerations is the sense-making process of individuals as they connect with the information available.

Dervin's Sense-making methodology draws upon a framework that consists of situations, gaps, and outcomes. The user in a specific time space context encounters uncertainty or a gap in their understanding of the situation. The process involves the discovery of the way they bridge those gaps to achieve outcomes. By collecting and analyzing the situations, researchers can began to understand the knowledge "structurings" that best bridge the gaps for different individuals and build use patterns and constructs that are not one collective understanding, but create a body of findings for resources, systems designers and information professionals (Naumer, Fischer, & Dervin, 2008). This is one aspect that addresses the equitable access of information by users; however, the problem still remains that governing entities and administrators

need standardized ways to measure, locate, and understand the information that is available in an efficient manner.

In speaking of information and equity Lievrow and Farb (2003) bring a collective definition based on multiple views of equitable information in which they refer to, “the fair and reasonable distribution among individuals, groups, regions, categories, or other social units, such that those people have the opportunity to achieve whatever is important or meaningful to them in their lives” (p. 503). This suggests that both an understanding of lived realities and the practical measurements of standard elements are both integral to an understanding of equitable access. McCreadie & Rice (1999 a, b) bring this suggestion into consideration in their construction of a theoretical framework that spans multiple disciplines and perspectives of information.

McCreadie and Rice’s conceptualization of access to information is a two part literature review that looks at how six different research strains define information and access. The areas they use include library studies, information science, information society, mass media, organizational communication, and economics of information. From these six perspectives the authors are able to construct a consensus of four conceptualizations of information, six conceptualizations of access, seven influences or constraints to access, and four facets of information seeking (McCreadie & Rice, 1999 a, b).

In the concluding portion of the articles, the conceptualizations are discussed in terms of the way that information perspectives influence access and vice versa, and how

the influences and constraints act as agents of change in the way the user perceives access and the way he or she goes about information seeking. A comprehensive framework such as this provides a unique opportunity to study complexity of populations systematically because it makes space for multiple views to be assessed in conjunction. Information access may be seen as especially good quality from one conceptualization and less so from another. The research will use this framework in conjunction with a government information framework in order to apply it to the problem at hand. With its attention to multiple conceptualizations of information, the government framework allows for both the concerns of the government agencies involved in providing efficient and equal outbreak prevention and risk communication efforts to be examined in conjunction with dimensions that can model contextual factors to represent the conceptualizations of the cattle producers within each state. Part of this analysis will look at the level of quality of the information as a standard construct and thus the research looks at the scholarship that develops such dimensions.

Information Quality

Studies in information quality (IQ) often address the fact that definitions of quality information are subjective and scholars often stress the need for contextualized study (Alexander & Tate, 1999; Kahn, Strong, & Wang, 2002; Knight & Burn, 2005; Stvilia, Gasser, Twidale & Smith, 2007; Wang & Strong, 1996). Nevertheless, defining standards of quality in information resources are important elements to understanding equitable access to information. For example, in government information dissemination,

the Office of Management and Budget (OMB) upholds the standard defining quality criteria. Multiple definitions of quality exist within the literature, but there are a lot of overlapping ideas that frame how the field conceptualizes quality information. The following table (2.1) summarizes the categories and definitions gathered in an extensive literature review in Boehm (2012). These definitions of accuracy, currency, authority, usability, and visual quality represent the categories the research will use as a portion of the content analysis process delineated in chapter 4.

Table 2.1. Categories of Information Quality Adapted from Boehm (2012)

IQ Categories	Description	Authors
Authority: Reputation	The high status and/or knowledge level (socio-culturally defined) of the affiliated agency, institution, author, or content	(Alexander & Tate, 1999; Kahn et. al., 2002; Knight & Burn, 2005; Stvilia et al., 2007)
Authority: Transparency	Clarity of affiliation	(Bonati, Impiociatore, & Pandolfini, 1998; NSF, 2002)
Currency: Timely	Timeliness or the extent to which the provided information is up to date	(Alexander & Tate, 1999; Kahn et. al., 2002; Knight & Burn, 2005; Wang & Strong, 1996)
Currency: Influential	Is novel to the user and has a "clear substantial impact"	(OMB, 2002)
Accuracy: Correctness	An information object's ability to provide a correct and reliable representation of another process, event, phenomenon or object	(Alexander & Tate, 1999; Kahn et al., 2002; Knight & Burn, 2005; Stvilia et al., 2007)
Accuracy: Objectivity	Focus on ensuring accurate, reliable and unbiased information	(OMB, 2002)
Usability	Visual clarity and components that foster ease of use	(Klobas, 1995; Wang & Strong, 1996; Alexander & Tate,1999; Kahn et al., 2002; Knight & Burn, 2005; Holmes & Robins, 2008; Nielson, 2011).
Visual	Aesthetic quality and degree of professional design components	(Lindegaard et al. 2006) Holmes and Robins, 2008)

By establishing these understandings of information behavior, needs, seeking, and access, the research has shaped the initial theoretical base from which to explore the problem. Another area of literature that is integral to the understanding of current scholarship exists at an intersection between agriculture and information research. The following discussion addresses other scholars that are looking specifically at how those in agricultural fields as producers and other professionals think about and use information.

Agricultural Information Studies

One theme that appears throughout the literature is the exploration of what channels of information are preferred and most often accessed by agricultural producers (Chowdhury & Odame, 2013; Demiryurek, Erdem, Ceyhan, Atasever, & Uysal, 2008; Graybill, 2010; Gualtieri, 2012; Jensen et al., 2009; Rutsaert et al., 2013). Jensen et al. (2009) found that 60 percent of the cattle producers surveyed in Tennessee in 2006 looked to multiple channels for veterinary information. At the time in this region, use of the Internet as a source for information was low, but more often accessed by younger farmers with a higher level of education.

Literature at the intersection of agriculture, information science, and ecological economics are currently focusing heavily on information seeking practices in countries outside of the US. Scholars are addressing issues of the construction of user focused data management tools and services for farmers in developing countries. For example Ali (2013) compares the farmer's perspective on the quality of information delivery

between private and public sources in India. Researchers in Iran looked at factors that influence information seeking knowledge among wheat farmers to find that social, farming, and personal characteristics explain almost 80 percent of the variance in this knowledge (Dinpanah & Lashgarara, 2011).

Other studies in Australia are looking at the socio-technical complexities involved in the design of decision support systems (McCown, 2002), and in integrating farmer knowledge into the development of precision farming tools (Oliver, Robertson, and Wong, 2010). One objective that agricultural information studies are often looking at is defining the personal, social, and technological factors that influence the decisions and practices of the farmers (Dinpanah & Lashgarara, 2011; Greiner & Gregg, 2011). Specifically, an area of intersection between agricultural producers and information science that scholars have previously explored is the motivating factors for adoption of technology, or adoption of new practices related to decision making (Cope, McClafferty, & Rhodes, 2011). Greiner and Gregg (2011) looked at how motivations and goals to adopt conservation practices were influenced by specific subjective constraints. Using a survey and factor correlations, the study found that many of the farmers were more motivated by notions of personal and family perspectives than financial opportunities or pitfalls. Cope et al. (2011) looked at the factors that led to land use decisions among farmers in the Midwest. Using a mixed method approach, they discuss nuances of economic, social, and geographical issues to the adoption of new planting practices.

A select few studies in North America in the recent past have used naturalistic or critical approaches to exploring information seeking behaviors and information practices of farmers. Case and Rogers (1987) studied farmers using an experimental online system for accessing information. In the study participants remarked that processes of dealing with information was one of the most important tasks for their current operations. In another study Leckie (1996) looks at the role of gendering in agricultural farming information practices in Ontario and information channels for female farmers. She used in-depth interviews to understand and discuss critical feminist issues within the communities.

Research in Europe in the past two decades has looked at information technology use in different areas of agriculture as the idea of a network society became increasingly prevalent. Thysen (2000) provides a literature review of studies done in the 1990s that explore different tools and services within the concept of the information society. The ideas presented are optimistic and innovative and Thysen concludes that even though they may not use technologies as much at this time, farmers will want more operational support and services for their decision making process as IT tools and services become increasingly commonplace.

There is a large juxtaposition encompassing this complex situation of regional and contextual specificity when compared with the reality of what Thysen (2000) and others refer to as the information or network society. Defined as a society fully enmeshed, organized, and driven by social and media networks, the concept of a

network society changes the data and information environment with which one examines US cattle identification and traceability issues (Castells, 2000). Information behavior in the online environment as network society creates a space with collapsed boundaries of location and in some cases, social status. Scholars have noted an amplification of emerging real-world issues in online communities (Finn, 2011). It is important to note that there are opportunities for collaboration among members of rural communities that were previously inaccessible. Additionally, information in online spaces is open to consumers. This adds a double-edged sword of transparency: transparency as heightened awareness of risk, and transparency as greater ability to provide consumer confidence (Verbecke, 2005).

The study of the online interactivity among agricultural producers raises questions about how participants are interacting and how this affects the sharing of ideas and the types of knowledge created and disseminated. Studies are suggesting the need for diversification and identification of consumer groups with user needs and specific motivations when looking at the food industry and information about agriculture (Graybill, 2010; Verbecke, 2005). Previously observed stakeholder goals in relationship to diffusion of innovations include: social media for social marketing campaigns, community engagement, fundraising, and enhancing the outreach of business and science (Chowdhury & Odame, 2013). Stanley's (2011) New Zealand based study on social media in agriculture takes a social capital perspective and defines four key areas of value: networking (farmer to farmer); industry knowledge, Extension, and

marketing (farmer to agricultural industry); consumer engagement (farmer/industry to public); and crisis communication (two-way communication).

Another situation where interactive participation is being assessed involves the realm of eGovernment and government information studies. This is especially important when thinking about the interaction between the two overarching populations that the research is addressing because it helps to understand how data and information are transmitted and perceived. Knowledge of existing gaps in communication and information perspectives between the populations is an important component to understanding how the research conceptualizes information access.

In Eschenfelder & Miller's (2007) study on state based website materials for citizens on Chronic Wasting Disease (CWD), the authors assess the variations in scope of text information available on four state websites. They suggest that the current level of agency analysis is insufficient when it does not take into account the characteristics and information needs of the populations that the information in intended for. In accordance with this observation, their Government Information Valuation Framework (GIV) develops a spectrum of potential citizen information seekers and defines characteristics for each of these specific categories of users. The citizens are characterized based on their role in and their use of information about CWD.

In further work using the GIV framework, Boehm (2012) extends the analysis to evaluate federal government websites and information resources about Colony Collapse Disorder. The study adapts the citizen user framework to adhere to the scope of the

information seeking users related to the situation at hand and adds elements of information quality and interactivity into the understanding of the full scope of the accessible resource properties. An additional component of the study and in other government information studies such as Schreiber and Carley (2005) use social network analysis to look at the sharing of resources and communication among the different entities involved. When dealing with distributed bodies of knowledge and cultures of work, this method will illuminate situations that may not be visible in other types of analysis.

Network Analysis

Network analysis is a method of analyzing behavior, communication, and interaction such as information transmission by looking at patterns, strengths and weaknesses in the ties between actors or entities (Freeman, 2014). Analysis is often used to strengthen understanding of the layout of a situation or to predict and/or shape future situations and interactions.

The method of network analysis and social network analysis, that one uses today comes from multiple disciplines but originates in computer and network science as network theory. The concept of the network is an original pillar of discrete mathematics with evidence of its use for problem solving dating back to the 1700s (Newman, 2003). In the 1930s, scholars such as psychologist Jacob Moreno introduced the concept of sociometry, studying the interrelations of social groups on a micro scale by charting individual's connections within a group (Moreno, 1934). Additionally, the

concepts of the small world phenomenon and six degrees of separation expand and refine the idea that one can use the mathematical properties of networks to understand behavior of groups, organizational communication, and social phenomena (Milgram, 1967).

Independently of the study of social connections and organizational communication that fall under the term social network analysis, networks were studied in areas of physics, exploring the behavior of complex networks and analytical tools such as random graphs and small world networks (Albert & Barabási, 2002; Barabási & Réka 1999). Applications also abound in biology and epidemiology (Barabási, Gulbahce, & Loscalzo, 2011), and in bibliometrics (Price, 1976) to name a few of the many related scholars who are integral in constructing the foundations from which current analyses emerge.

With the rise of the Internet and web 2.0 technology, as well as with an increasing ability to develop highly automated digital tools for large scale analysis, network analysis and social network analysis have become increasingly important to scholars studying online behaviors and the flow of communication and information (Newman, 2003). It has been used across multiple domains for applied work from operations research in the US Air Force (Renfro, 2001), to exchange of information about agrodiversity through producer networks (Isaac, 2012), to analysis of tweets about politics (Aussenhofer & Maireder, 2013). One scholar even combines network analysis with a cattle tracking project (Nohuddin, Christley, Coenen, & Setzkorn, 2010).

Focusing mainly on the use of network analysis in data – mining analysis they introduce two types of techniques: Trend Mining Total from Partial (TM-TFP) and a visualization element of self-organizing map that clusters similar trends. The database that they use to do this is the Cattle Tracking System (CTS) an online database that tracks all the movements of cattle between locations in Great Britain. Each location is a node and the cattle movements are interpreted as weighted lengths between node pairs. The authors set up the experiment to trace these movements over an increasing amount of time, up to two years.

In Newman's (2003) comprehensive overview of network analysis he looks at multiple ways that the theoretical understanding of networks can be applied. Of the main motives of the theory he states that network analysis, "aims to find statistical properties that characterize the structure and behavior of networked systems… create models of networks that can help us to understand the meaning of these properties…to predict what the behavior of the networked systems will be on the basis of measured structural properties and the local rules governing individual vertices" (p.2). To think about social networks and information networks such as the research plans to address, the statistical properties of the system are less important than the way that the visualizations allow one to map the current landscape of information. In this case, network analysis becomes the avenue to a holistic visualization.

Through a multidisciplinary literature review of research focusing on areas of cattle identification and traceability, agroterrorism and biosecurity, information

behavior, government information, and information access, chapter 2 forms the basis with which the current research emerges. The following chapter, chapter 3, introduces a new model, an amalgamation of two theoretical frameworks in information science which will fuel the design of the research process. Chapter 4 will then relay the methods used and describe the two phase process the researcher took in order to answer the research questions set forth in chapter 1.

CHAPTER 3 – A SHIFT IN PARADIGMATIC PERSPECTIVE ROOTED IN FRAMEWORKS OF INFORMATION ACCESS AND CITIZEN USER NEEDS

In chapter 1 the researcher introduced the issues of social complexity surrounding identification and traceability information resource provision and developed four research question to assess the current landscape of resources as they relate with the equitability of access around the country. In chapter 2 the literature review provided a background into previous scholarship in multiple disciplines that play a role in establishing the knowledge base with which the issue is analyzed. In the current chapter 3, the researcher introduces a new perspective for structuring the analysis. This model, the Contextualized Information Access Valuation (CIAV) model arises out of a philosophical base of transdisciplinarity to merge two information science frameworks. Together these frameworks applied as one model, provide the basis for the research design.

Transdisciplinarity and Wicked Problems

In this study, the review of previous research suggests that the issue of cattle identification and traceability in the US is a wicked problem. Wicked problems are defined as such because they are socially complex i.e.: the definition of the problem is itself unclear and proposed solutions add greater complexity to the problem definition, there are multiple stakeholders with extremely different views on how to address the issue, the constraints of the issue and resources needed to address these constraints are constantly changing, and there will never be a final solution (Conklin, 2005). Many

agricultural issues can be seen as wicked problems, simply because of the importance of these issues to all realms of a society.

Beef industry specialists have alluded to a similar view of the situation (Ringwall, 2014). Given this understanding the analysis of information behaviors surrounding the issue needs to take into account the social complexity with research that focuses on social processes and communication systems. This is an important aspect to a human-centered design approach to information resources, services, and systems. For example, Horst Rittel, who introduced the concept of issue-based information structure, explains that the human centered approach is focused on the aspects of human interaction and social relationships as one of the key components behind the design (Rittel & Weber, 1973). While part of the analysis includes processes to quantify what is available, the social perspectives in relation to that material and the quality of the measurements will not be forgotten.

Another important element of studying such wicked problems is for researchers to venture outside of their domain of study and into ways of seeing that allow for what social studies of science scholars call a new production of knowledge. Wicked problems can be seen in the light of Gibbons et al.'s (1994) Mode Two knowledge, which is "not locatable on any prevailing disciplinary map" and instead is addressed in applied contexts, without hierarchies, and with frameworks that retain the complexity of the group processes (Meyer, 2007, p.6). Meyer (2007) in his discussion on problem framing argues that this type of research needs to be approached from a transdisciplinary

methodological standpoint. Nicolescu (2010) defines transdisciplinarity as “a study of interaction of the subject and the object with the potential of constructing new knowledge” (p. 7).

Transdisciplinarity as a lens for this research looks at the nature of reality as made up of multiple perspectives. These perspectives exist simultaneously on multiple levels. This correlates with the wicked problem concept that multiple stakeholders often have extremely different views about an issue; yet, it allows for the compilation of expertise from multiple areas of life. One such example is the expert knowledge that cattle producers from specific regions and operations can bring to an online space. Epistemologically, transdisciplinarity holds that the knower and the known are inextricably linked. One would not exist without the other (Nicolescu, 2010).

In accordance with this understanding, the research uses a broad framework of apriori definitions to situate elements of both qualitative and quantitative inquiry within the same research design. This aligns with the ontological assumption of transdisciplinary research that realities are constructed through a combination of the lived experience of the individual in context with the information and the shared knowledge of communities of practice applying their efforts to best construct and measure the efficiency and effectiveness of the services they provide (Nicolescu, 2006). Finally, with the application of the theoretical constructs of access to information and extended with the contextualizing component of the GIV framework for analysis, the research acknowledges the axiological assumption that such frameworks are the

shaping components for the study. By using these frameworks, the research injects certain values and concepts in all aspects of the inquiry. In alignment with the transdisciplinary understanding, the frameworks allow for multiple value structures to exist simultaneously.

Measuring Access by Merging Frameworks

While McCreadie and Rice (1999 a, b) define access to information according to multiple dimensions with theoretical definitions of each dimension and discuss the relationships between these dimensions, in practice; however, the act of analysis of equity in information access requires a way to operationalize such concepts in ways that make sense to the situation at hand. For example, one access influence or constraint is economic. The authors give examples or components such as; benefits, costs, and value as well as implications such as “reinforcing the link between socio-economic and informational class” (p. 62). The research needs a concrete way to understand such concepts in congruence with the specific nature of the state information about cattle identification and traceability. In order to address this government information problem the research augments the access framework with a model that demonstrates past evidence of pragmatic application to evaluation of government information resources.

The government information valuation framework (GIV) was used to evaluate both state and federal government Web information resources on highly controversial environmental problems in previous research (Eschenfelder & Miller, 2007; Boehm, 2012) and the constructs of this applied framework fit within two of the four dimensions

of the theoretical access framework to a create a functional model. Figure 2.1 shows the original synthesis of dimensions of access and Figure 2.2 shows the merging of the two frameworks and labels the dimensions of access according to their role in evaluation of distributed information resources. An amalgamation of the two frameworks, the new merged framework, is entitled the Contextualized Information Access Valuation Model (CIAV).

Conceptualizations of Information

Conceptualizations of information, the constructs in the upper most dimension, function in a similar way to how individuals see the world (e.g.: their paradigmatic perspective), thus they provide overarching assumptions about information as a concept that acknowledge and reflect the complexity inherent in a transdisciplinary understanding of access to information (Nicolescu, 2006, 2010). Conceptualizations exist on the theoretical end of the theory to practice spectrum and as McCreadie and Rice (1999 b) suggest, the dimension of influences and constraints on access in practice will influence the theoretical conceptualizations of information.

Conceptualizations of information become the representation of varying perspectives inherent in both potential state user perspectives and the existing state information provided. The first part of the research design looks at the state information perspectives based on the combination of content available from each state's Department of Agriculture and that state's cooperative Extension website. The following

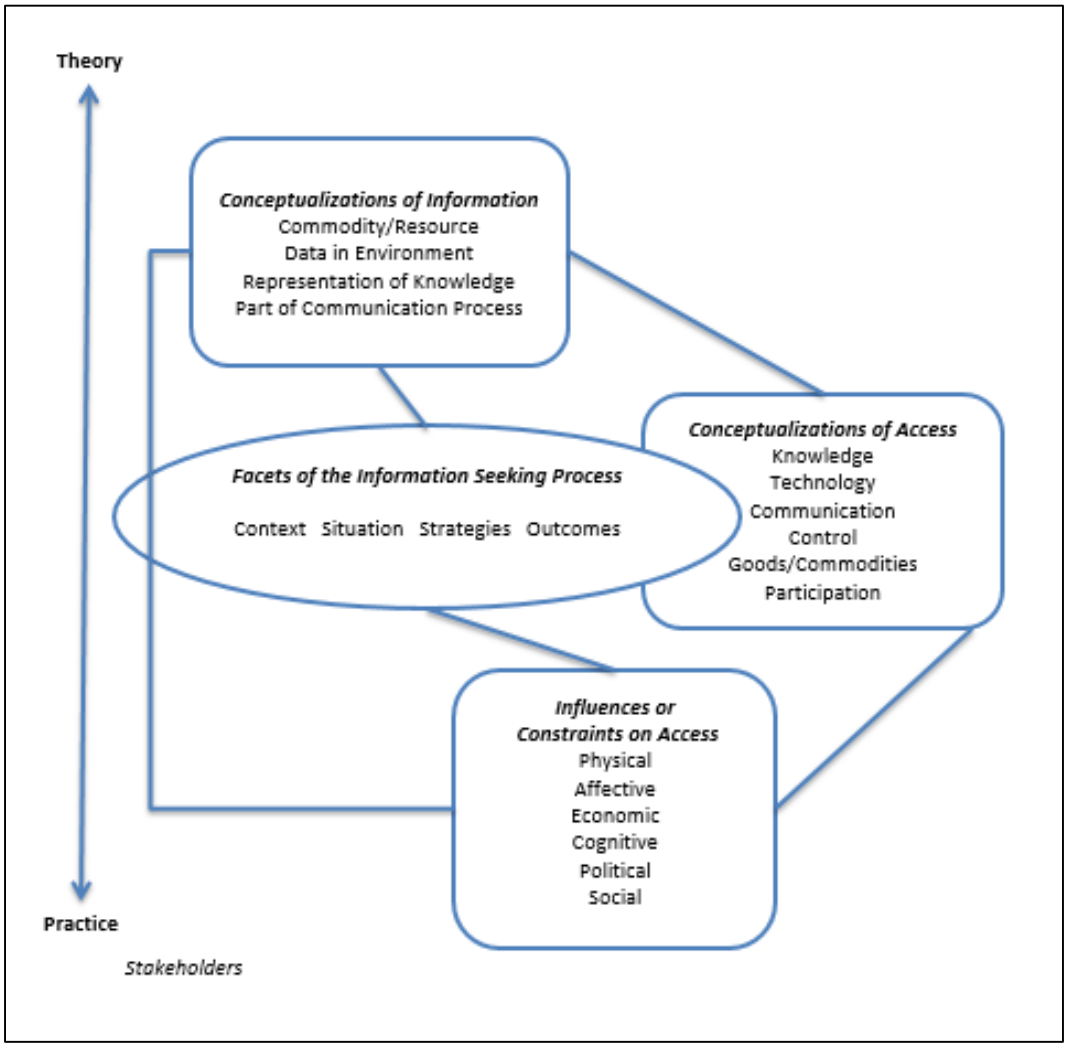


Figure 3.1 McCreadie & Rice (1999 b) Original Synthesis of Dimensions of Access to Information

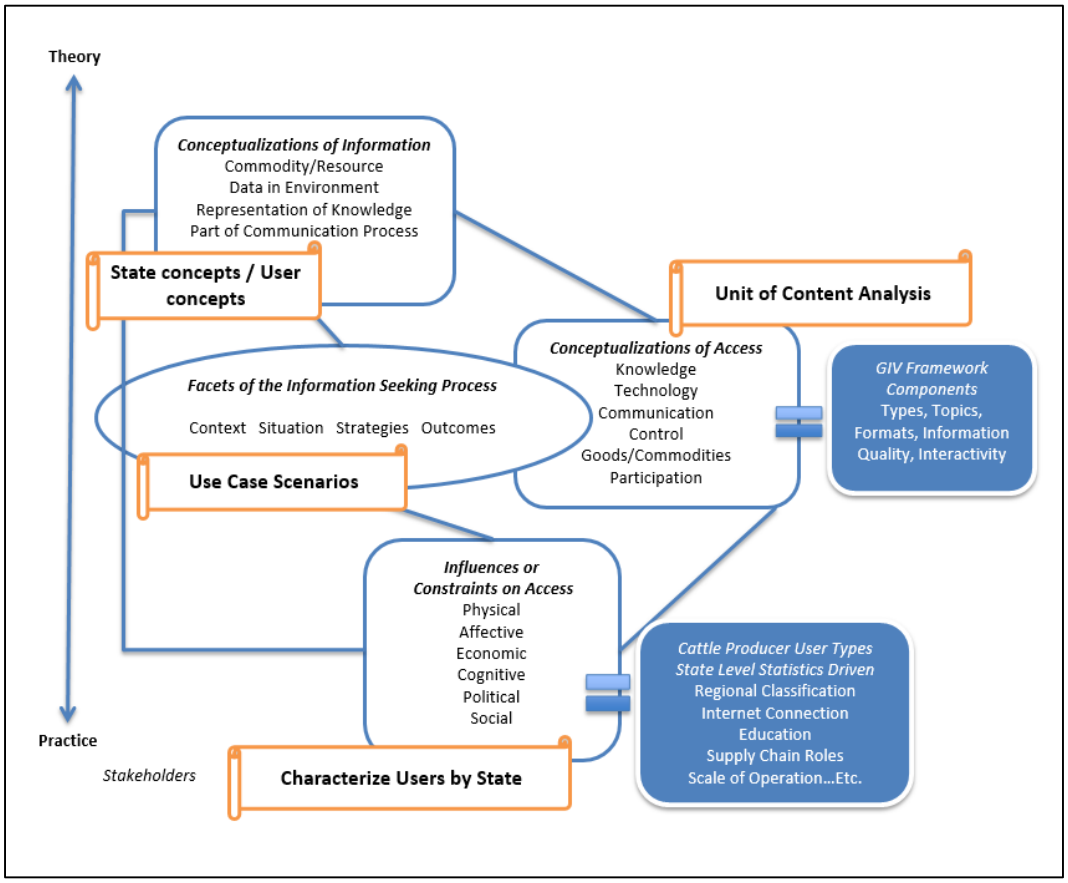


Figure 3.2 Contextualized Information Access Valuation Model (CIAV)

table 3.1 shows the relationship between the conceptualizations of information and the conceptualizations of access, which will become the content analysis units. The components of the content analysis answer questions about conceptualizations of access that are most salient to the corresponding view of information as a concept.

Table 3.1 Relationship between Information and Access Concepts in the Original Framework

Information Conceptualization	Description	Access Relationship
Resource or commodity	Assumes a sender to receiver transmission - a fixed product for exchange	Goods and commodities
Data or observations	Objects and artifacts or naturally observed phenomena – unintentional communication	Technology and communication
Knowledge representation	Documents and sensory representation – technology and science are seen as primary	Knowledge
Communication process	Info meanings are constructed through communication process	Control and participation

Dimensions of Access to Information - Roles in Research Design

Conceptualizations of Access and the GIV Categories

Conceptualizations of access take into consideration the way that one thinks about access as a construct. These are not mutually exclusive to a research discipline, nor would each be considered mutually exclusive to the way that one population defines access. In thinking about the properties of government information as defined by the constructs in the GIV, one can make connections in definition between these ideas of access and the ways in which previous government information evaluation studies assess the information available through a particular channel. The following

table 3.2 maps the similarities between the access concepts and GIV elements and operationalizes these constructs for use in analysis.

Table 3.2 Relationship between Concepts of Access and the Components of the GIV

Access Conceptualization	Description	GIV – Description
Knowledge	Messages sent Flows of information Observation, evidence	Topics – the subject addressed in content
Technology	Systems of delivery Media used Mediation	Formats- the way the content is packaged
Communication	Content comprehension Ability to use Relevance	Information Quality
Control/Participation	Who stipulates terms Voices heard Services offered	Interactivity
Goods/Commodities	Info as public good Costs vs. Benefits Distributions of control	Types – the function of the resource

Influences and Constraints on Access and Cattle Producer Populations

The dimension of influences and constraints on access is the second dimension that in conceptual definition overlaps with the GIV framework. Influences and constraints to access are based on circumstances or experiences of the user and help to define the users' information needs (McCreadie & Rice, 1999 a). The GIV framework includes a citizen user spectrum that delineates the level and characteristics of the interaction of the individual with the resources based on specific characteristics of their role as a citizen within the public sphere (Eschenfelder & Miller, 2007). Boehm (2012) adapted the citizen user spectrum to adhere to citizens in their use of government

information related to Colony Collapse Disorder. The previous user spectrums relate to needs based on activities in civic engagement roles in both cases.

In the case of cattle identification and traceability information from the states, the research is looking at particular user groups less in the interest of interactivity for the sake of discourse and engagement, but instead in the overall interest of best serving the perceived information needs of the producers accessing information. Using the concepts of influences and constraints in a similar position allows the research to characterize and contextualize the experience of potential users within each state.

Each state will have a unique influence/constraint profile that puts the state content found and assessed in the analysis in a situation in which the research can compare the content with the context. There is not a one to one relationship between the influences/constraints dimension constructs and the access dimension constructs nor is it possible to quantify the exact relationships between the dimensions. What the framework creates is a standardized profile of elements that influence the accessibility of information beyond taking stock of the information from one perspective for all the states in the nation without consideration of demographic, socioeconomic, and regulatory differences. While not all cattle producing residents of the state fit in the user profile constructed for the state, and other confounding factors may still exist that influence access, the statistically based profile acknowledges a majority of circumstances that may hinder or influence what information is considered most salient.

After all the states' information profiles are discussed with the information gathered in the content analysis, states can be compared at the national level according to certain strengths and weakness of content provision. For example, if Tennessee has mainly cow-calf producers, and those cow-calf producers are on average very small-scale operations and the majority of the information is about high tech identification processes, this could be considered a weakness in the saliency of the topics based on the social and economic components of the profile. By creating visualizations of the relationships between context and access in the states, the research can be a reference for states that have similar profiles to work together to understand the best ways to provide equitable access to their populations. It also shows government officials the landscape of information and practices in context. This can be a resource in understanding the practices and serving the information needs of an area in the event of an outbreak and in uncovering areas of the nation where it may be easier or more difficult to track cattle movements to the source. This is done through a combination of creating visualizations of results and network analysis to visualize shared resources and topics while at the same time comparing the characteristics of resources with levels of demographic context.

Facets of the Information Seeking Process

Facets of the information seeking process is a dimension of the framework whose constructs are defined by the actions of the user in context; the user in context being that which is described by the influences and constraints dimensions. McCreadie

and Rice (1999 a) establish the facets of the process as having four constructs: context, situation, strategies, and outcomes. This is similar to Dervin's aforementioned sense-making methodology and the situations, gaps, and outcomes model. Dervin (1983) represents the construct of context by illustrating the model in a specific axis of space and time. In this case the research groups this axis of space and time in conjunction with the other facets to understand multiple use cases.

In order to understand the process from different types of user perspectives, the research develops and discusses three use case scenarios in chapter 9 following the results of the analysis to talk through potential situations: two from the perspective of working groups of information professionals each in a different situation and one with a hypothetical storyline based on the potential experience of a small scale producer looking for information. Use case scenarios are beneficial because they allow the investigation to take different user perspectives into consideration, even in the event that the user populations are inaccessible. This might be the case in emergency situations, when the aspect of timely distribution makes all the difference. It is important to note that this portion of the analysis can also be used as a demonstration for the way that the framework presented in the research could be used at full capacity in the design of information resources that focus on equitable access for a diverse group of distributed individuals. Future work will expand to interviews or focus groups with members of the populations that can provide an actual assessment through the information seeking process.

Operationalizing the CIAV Model

Earlier in this chapter the researcher introduced the design of the Contextualized Information Access Valuation (CIAV) model as a combination of the McCreadie and Rice's (1999 b) synthesis of dimensions to information access framework and Eschenfelder and Miller's (2007) government information valuation (GIV) framework. The theoretical backbone of the framework is the dimensions to information access which includes four separate yet related dimensions that exist on a spectrum from theory to practice. While this framework presents a picture of multiple perspectives on the issue of access to information, the constructs are not yet set in such a way as to be operational for analysis of a specific information environment or body of resources. The GIV framework overlaps the constructs in two of the dimensions as the definitions are congruent and it is used in previous applications (Boehm, 2012; Eschenfelder & Miller, 2007) as a viable framework for use in evaluating government information in context. This addition to the base framework provides the necessary components to create a new model for use in the current analysis.

In order to describe the relationship between the constructs and the way that they are measured in the analysis, the following portion of this chapter operationalizes the dimensions prior to the discussion of the process. The information conceptualization dimension is the link to the realm of information theories about access, thus the components play an overarching role in guiding basic perspectives about information as a concept. McCreadie and Rice (1999 a, b) develop definitions through their literature

review and this research extends these definitions to reflect the relationship to the access questions involved in the analysis. Table 3.3 lays out the four concepts of information and the relationship with the involved access questions.

Table 3.3. Conceptualizations of Information Operationalized for the CIAV Model

Information Conceptualization	Operationalization Relationship
Resource or commodity	Specific types of information and the amount of each type
Data or observations	Formats, the amount of each, and the quality of the information
Knowledge representation	Specific subjects addressed and the amount of each subject
Communication process	Availability of interactive components and the amount of participation the components offer

The access questions above stem from an understanding of the five conceptualizations of access to information that are defined by McCreadie and Rice (1999 a). The elements of analysis in the GIV framework overlap these concepts in definition and have a history of application to draw from in operationalization for the content analysis. Table 3.4 shows the access construct and the corresponding way that the specific construct is measured.

The conceptualizations of access hold a primary place in the middle of the theory to practice spectrum for their role as the space for the content analysis of the information resources. This position suggests that the access components are a linking element between the two worlds. Both the theoretical information components and the influences and constraints of the user's world act to influence how the researcher perceives the value of that component of the information.

McCreadie and Rice define six influences or constraints. These influences or

Table 3.4. Conceptualizations of Access Operationalized for the CIAV Model

Access Conceptualization	Operationalization
Knowledge	Categorize and count topics in content. List of topics developed from thorough review of literature on cattle identification and traceability.
Technology	Categorize and count formats as they appear as content. List of formats developed from Zamzar 2014 comprehensive list of file formats.
Communication	Information Quality- will use the checklist of parameters adapted from Boehm (2012) IQ definitions
Control/Participation	Interactivity – will use the interactivity parameters adapted from Boehm (2012) interactivity components
Goods/Commodities	Count types in retrieved content. Types are based on DCMI Type Vocabulary definitions

constraints echo the citizen-user spectrum used by both Eschenfelder and Miller (2007) and Boehm (2012) because they address the contextual factors that would influence the information needs and behavior (including perceptions of access) for particular user groups. In the citizen user spectrum of the GIV the roles and corresponding information needs of the users are defined through the literature review and a working knowledge of the situation. Here, the CIAV model uses secondary statistical data available through federal and state government resources to form the state user profiles. Table 3.5 shows the data for use in defining these user profiles based on the specific type of influence or constraint.

Table 3.5 Influences or Constraints on Access Operationalized for the CIAV Model

Influences or constraints	Specific to population	Operationalization
Physical	Location	Regional classification of state as determined by NASS
Affective	Use of internet considered as a source for information	State level number of cattle operations with Internet connection.
Cognitive	Level of Education	State level statistics of producer educational level as determined by 2012 Ag Census data
Economic	Scale of operation	State level classification of scale of operations as determined by 2012 Ag Census data
Social	Role in supply chain	State level distribution of cattle producers in phases of operation: cow-calf, stocker, feedlot, multi-phase.
Political	State level of regulation	Status of regulatory capacity of identification measured on a five point scale

Through this chapter the researcher provides a new perspective for assessment of equitable access to information resources about a socially complex issue through a

model that merges two theoretical information science frameworks. Chapter 4 follows delineating the methods used in the research design to answer the four research questions. Chapters 5, 6, 7, and 8 immediately following the methods section will then report the results of each question.

A Note to Readers

It is important to note at this juncture between discussions of theory and method that the transdisciplinary and socially complex nature of the issue makes it difficult for the research to conform to all the rules set forth in different domains' scholarly research design conventions. The research uses mixed-methods and introduces new ways of looking at multiple variables based on the CIAV model. One will find that while the majority of the methods are spoken about in depth during the methods chapter, there will be further introduction of the new comparison method beyond the boundaries of the methods chapter. This is done in an effort to make the results discussed in that chapter more immediately comprehensible. These later methods remain a part of the overall theoretical basis introduced in this third chapter and relate to the CIAV model component "Influences and constraints to access."

The multi-faceted nature of the analysis may bring about questions of how to characterize such a method of analysis, and rightly so. If one cannot situate the analysis in a tradition of scholarship, how is one to judge the validity of the process or the results? To clarify, the researcher returns to the discussion of the network society in the information environment (Castells, 2000) from the literature review. If one thinks of the

CIAV model as the representation of the information environment, the analysis as a whole becomes an analysis of the information environment. The readers are invited to look at the information environment from these multiple perspectives that exist on a continuum from theory to practice. Naturally, when addressing different elements of the model, one needs to use different methods best suited to understanding the specific niche. The CIAV model structures an analysis that is part usability study, part content analysis, part relevance assessment, part secondary data analysis, and part network analysis. The following diagram figure 3.3 is intended as a reader's road map of the information environment to clarify how the CIAV model relates to the different parts of the analysis.

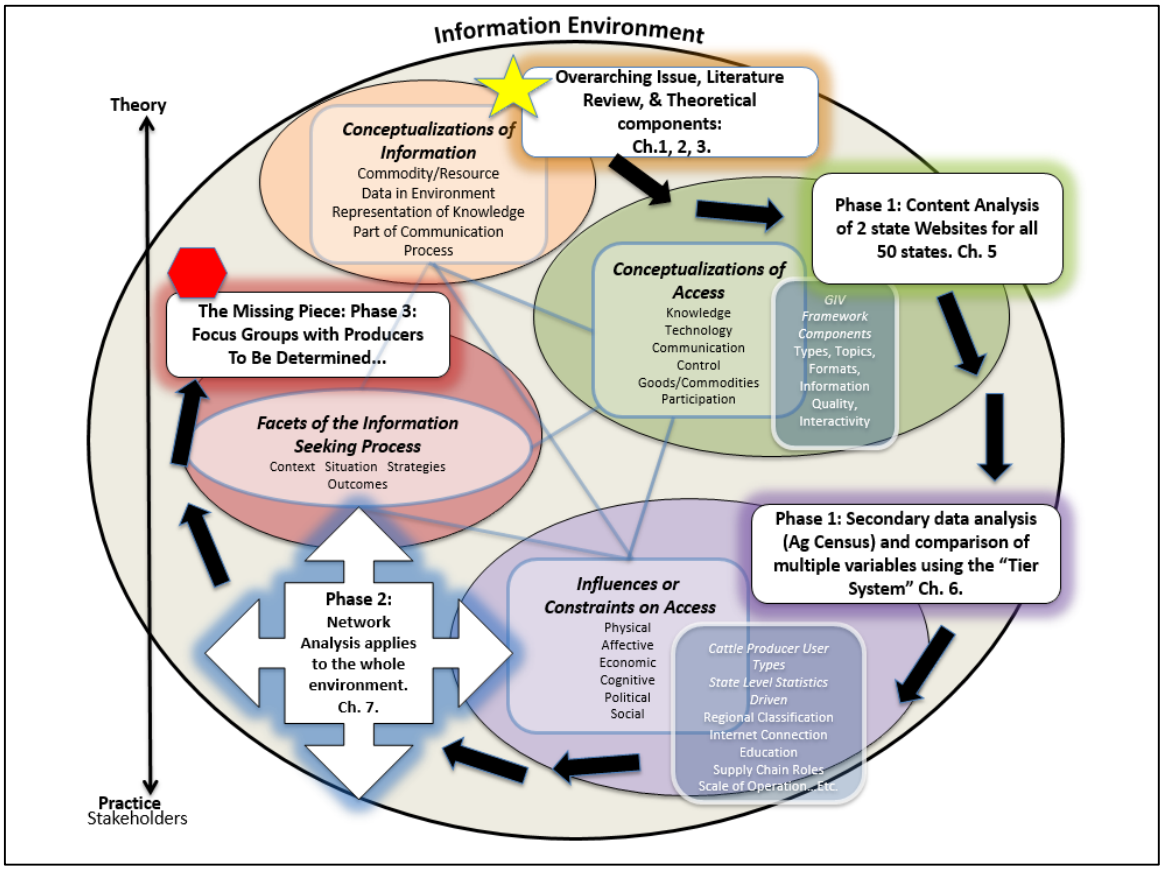


Figure 3.3 Roadmap of the Methods Used for the Information Environment Analysis in Relation to the CIAV Model

CHAPTER 4 - METHODS

The first chapter of the research delineated the major issues fueling the research project and presented the four research questions to address these issues. In the second chapter, the literature provided a background of previous study in the areas of information science, agricultural communication, agroterrorism and biosecurity, and cattle identification and traceability issues in the US. The third chapter introduced the CIAV model and operationalized the components that provide the structure for the research design. The current chapter 4 illuminates the research methods process to answer the four questions and will present the phases of analysis as well as the measures of reliability and validity supporting the execution of these methods.

The research design contains two phases to collection and analysis in response to the four research questions and the two overarching user populations. To address the perspectives of the cattle producers and access to information that is salient to their situation, content analysis allows the research to take stock of the documents and objects that provide that information in conjunction with what the information is communicating through the channels to the producers within the state. On the other hand, government populations will be looking for overarching pictures of the status of the states' information provision attributes. Content analysis alone does not provide the complete picture of the landscape. In phase two network analysis and graphic visualizations of the states in relationship to information resources allow the research to present patterns of linking and areas of focus for swifter access and holistic assessment

of the external information links provided by the states. Figure 4.1 shows a visual representation of the phases and steps that make up the research process.

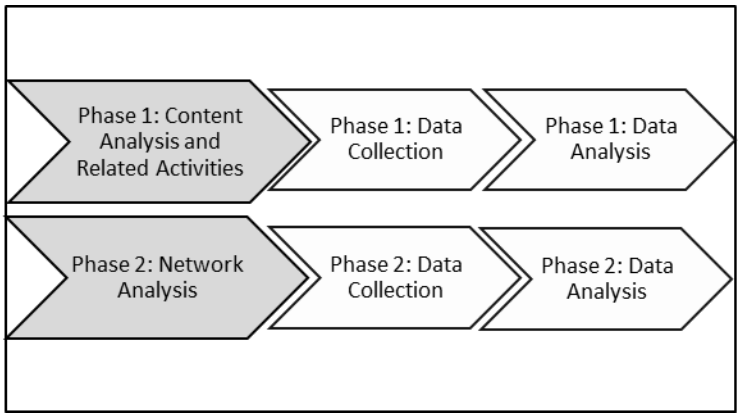


Figure 4.1 Phases and Steps of the Research Process

Content Analysis

In order to understand what information is available through the two channels within each state, the research uses quantitative content analysis of the documents retrieved. Content analysis is appropriate for this research because it allows for a systematic review of text and information media from multiple online sources (Zhang & Wildemuth, 2009). Apriori definitions of the concepts are necessary to assess all states initially according to the same standards. The following apriori definitions clarify the standard characteristics for the constructs. More in depth definitions for the content analysis components are found in the codebook which is provided in Appendix A.2 through A.4.

Information topics are defined as the subject matter of each retrieved piece of information and are developed and defined by the researcher through thorough review of the literature on cattle identification and traceability. Care was taken during the pilot study and throughout the data collection process to check for the appearance of additional topics. Topics are not singular entities; thus, a piece of retrieved information can include multiple topics.

- Guidelines and regulations
- Programs, events, and opportunities
- How-tos and instructions
- News stories
- Discussing types of technology, methods of identification
- Research
- Economic and financial considerations
- Basic information/overview of concept
- Dispelling myths or misinformation
- Food security: agroterrorism, disease outbreak, and risk mitigation

Information types delineate the function of the piece of information retrieved. It is possible for the type to adhere to a general consensus devised by Dublin Core. (The only type not used is physical object since the analysis is looking at online information only.) This allows for a functional categorization of type that is used as a standard for

defining objects in records everywhere. Types are also non-exclusive categories so each piece of information will be defined by an array of the types it contains.

- Collection
- Dataset
- Event
- Image
- Interactive resource
- Moving image
- Service
- Software
- Still image
- Text

Formats in the analysis are defined as the vehicle for transmission of a piece of information retrieved. There are many different potentials file formats for dissemination in the online environment. In order to best account for the majority of possibilities, the research looks to a free online file conversion service. Zamzar.com is a 2014 file conversion web service that provides a comprehensive list of file formats and definitions. The formats are too numerous to list, but the reference can be easily accessed at http://www.zamzar.com/fileformats/.

For information quality there is a rich history of literature looking at the defining standards that constitute a quality piece of information. The research defines

assessment parameters in which to operationalize measures as adaptations to the Boehm (2012) checklist for information quality. This checklist is a synthesis of previous information quality research. The original checklist considered interactivity as a measure of quality. In this case the research separates the interactivity portion of the measure to highlight this category as a different yet equally important element of information flow within the communication and information network. The study uses the following quality categories for analysis.

- Currency
  - The information has no broken links.
  - The information was updated within the past two years.
  - The content contained no information about canceled programs or projects.
- Source authority
  - Authorship is disclosed.
  - Contact information is readily available.
  - Institutional affiliation is cited.
- Accuracy
  - Content is free of known errors.
  - Content is free of misinformation.
  - Content is integral in providing the information the title/link promised.

- Usability and Design

Usability and design are defined using a checklist of ten criteria as defined by Jakob Nielsen (2011). These criteria include:

- A simple search field exists on the page.
- Any PDFs are reserved for manuals and large documents.
- Visited links changed color.
- The text is written for online reading and supports scan ability.
- The font size is not fixed or too small.
- The page titles are descriptive and short.
- There is no animation, no advertisements or pop-ups.
- The design is consistent with other content pages and sites.
- The links work as simple hypertext reference; new windows do not open.
- The answers and main ideas are visible as such.

Interactivity in the research is defined as a potential means for two-way flow of information between the cattle producer and the source of the dissemination (Boehm, 2012). Pieces of information that have any of the following properties will be counted as interactive.

- Offers user support/ help chat or email functions
- Advanced or user customized search options
- Open comment fields
- Interactive media or applications for wireless devices

- Folksonomy and tagging capability
- Offers a web 2.0 component
- Endorses a participation program
- Specific requests for producer input

Relevance is also an important aspect to include in the analysis because if the resource retrieved does not address the content, the topic category of measurement is not possible to assess. This measure also shows the success of the search engine and the actual saliency of the content retrieved. The researcher gives a value of zero (0), half (0.5), and full (1) relevance depending on the resource's actual coverage of any of the search terms.

Network Analysis

In order to best communicate the results in a way that will demonstrate the big picture of the states' distributed channels of information about cattle identification and traceability issues, the links to other resources that are found during the content analysis need to be presented in a way that can be looked at holistically to see where resources are shared and where states are not involved in external sharing. Too often it is the case that when moving from one report to the next, an information professional or a governing official, or anyone viewing data lacks the ability to see a bird's eye view of the situation. Pieces of the whole may be connected without knowing this to be the case. There may be some hidden gaps in communicating about important issues or states that are disconnected to vital information. The goal of network analysis and the

corresponding information visualization process is to create a resource that government officials and information professionals can use to map the network of external resources with the state website content.

The Sample

The sample for the research design is purposively chosen to reflect the nature of the current situation involving the federal landscape of cattle identification and traceability regulation and guidance in the US. The sample consists of two website resources for each state: the cooperative Extension office and the state Department of Agriculture.

USDA's Cooperative Extension System Offices

The USDA is the overarching government body involved in communicating about research and working in an educational and outreach capacity for the nation's agricultural processes and products. The cooperative Extension system is described as a "nationwide, non-credit educational network" (CREES, 2014). For every state and territory, an Extension office resides at the land grant university and there are further Extension offices to encompass the local and regional areas of that state or territory. The purpose of these offices is to provide usable and important information to producers and other stakeholders in the area. The research uses this resource because it is an established, authoritative network that links federal and state experts with beef cattle experts and because it is an integral information service nationwide.

State Departments of Agriculture

When the government made the final ruling for livestock identification and traceability that went into effect in 2013, the regulatory capacity was situated with the state to determine how the majority of the beef cattle are monitored and if they are regulated in any specific capacity beyond the minimal stipulations imposed in the final ruling. Each state government has a Department of Agriculture that, similar to the federal Department of Agriculture, governs the agricultural issues and procedures within the state. In consideration of this, the state Departments of Agriculture provide an additional source of potential state based information resources on identification and traceability to get a more complete picture of state specific resources.

It is important to include both web resources because they each provide a certain specific function in the way that they connect the producer with information. Both are an essential element in the understanding of the information and related practices for each state. One producer may use one source more frequently than the other for a multitude of reasons. Each of these networks of information have an entry page through the USDA to each state website, so the access of the resource is a standard process throughout. The following passage will develop this process further.

Procedure

In preparation for collecting the data for the content analysis, the researcher developed a codebook and a data workbook for documenting the information in a standard manner using Microsoft Excel spreadsheets. The codebook contains the

operationalized components of the dimensions of access to information framework adapted to reflect the application to the subject of cattle identification and traceability systems. The codebook spells out the process of data collection and analysis of content in such a way that the study can be repeated in other instances and other researchers can check for inter-coder reliability (Krippendorf, 2004). A portion of the codebook is devoted to the information access influences and constraints dimensions that will delineate the producer user profile for that state. To gain this information as set forth in table 3.5, the researcher accessed the state level statistical data for 2012 via the USDA NASS census and noted the measures in the codebook for that state in the allotted space. Definitions for the elements included in the codebook as well as process clarification for other researchers is included in the Appendix A.2 through A.5.

Content Analysis and Related Activities

Phase 1 - Data Collection

Data collection for the content analysis phase of the research started online at the USDA's Cooperative Extension System Offices webpage located at http://www.csrees.usda.gov/Extension/index.html. On this page is an interactive map of the fifty states, the District of Columbia and the US territories. By clicking on the state the user is directed to the link for the state office or offices of the Extension system. For example, the researcher clicks inside the state of Texas on the graphic and two Texas county offices are listed. The first is Prairie View A & M and the second is Texas A & M University. The researcher recorded these links and visited Prairie View first by clicking

the link. The researcher visited Texas A & M second by clicking on the link. In the event that a link to a website returns an error message, a note is made in the records for that state and the researcher moves on. Most states only have one state office and when there are two listed one is usually no longer viable. The researcher used discretion to discern the viable option and made notes to explain the choice.

For each state page, the researcher created a record by taking a screen shot of the home page, saving it as a PDF, and recording the date. In the instance that the link went to a page other than the homepage of the Extension website, such as a county directory, the researcher used that page if it had a comprehensive search of the website. If not the researcher took the necessary steps to reach the home page. After accessing the page and documenting it the researcher entered search terms in a search field. If a search field was not available, the researcher made a note and checked the website for any additional information labeled with the standard search terms. If a link to information labeled with the search terms was found, the researcher clicked this link and took a screen shot, created a PDF, and noted the date.

The majority of the websites do have search fields and in these search fields the researcher used the following terms from most specific to least specific: cattle traceability, cattle identification, livestock traceability, livestock identification, animal traceability, and animal identification. Traceability is used here because after engaging in a short pilot test the researcher found that although identification is an intrinsic component to traceability, the word traceability yielded larger amounts of relevant

results that were different than those for identification. Prior to this discovery the rationale was that some states could have resources on identification without discussing traceability systems and the research needs to identify this; however, the variability in the usage of the terms made leaving out the term traceability a large oversight of relevant data. If cattle traceability produces results, the researcher did not use the more general search terms. If it did not produce results the researcher made a note and moved on to cattle identification, stopping or continuing depending on the retrieval of ten results. If nothing was retrieved for any of the search terms, the researcher made a note and then followed the same procedure that one would follow if there were no search field. The first ten resources retrieved that use the search terms were captured as a PDF and used in the analysis. In the instance that results were retrieved and there was also a link to information on the resource pages that used the search terms, these URLs were also captured according to the standard procedure previously mentioned for further use in phase two.

Then for all webpages the researcher ended the search on each home page website by looking for links to information from the home page and documenting those pages for use along with the retrieved content. (There were very few). The researcher documented retrieved content for the search term by visiting the link, recording the URL, and then saving the page in the standard procedure. If there was a way to filter the results, the researcher used the “relevance” filter. The researcher limited the documentation of results for analysis to the top ten results; however, the researcher

also noted the number of results retrieved in the initial search. The researcher limited the analysis process to the first URL of each record retrieved and did not evaluate deeper into linked content. This process continued until all the states were documented. Each state had a folder containing the retrieved pages ready to begin content analysis.

The second area where data was collected in phase one was through each state's Department of Agriculture. The same process was followed as delineated above. State Departments of Agriculture are all accessible from the USDA Risk Management Agency at http://www.rma.usda.gov/other/stateag.html. Again, the researcher used the search process to systematically gather the data for each state. The researcher chose to do only the fifty states at this time. The District of Columbia is included with Maryland for the USDA NASS statistical criteria and there is little to no cattle production in the nation's capital. Territories of the US are important to assess; however, at this time the major concern is for the areas of greatest impact because of their location, population, and involvement with the production industry. Future research will include the US territories.

The third part of the data collection process was the collection of the demographic data previously mentioned that makes up the states' demographic profile for cattle producers. The researcher used a combination of census data summaries and the Quick-Stats Ad-Hoc Query Tool to access the state data that addresses the

categories related to the dimensions of access in the CIAV framework. The following components were gathered:

- Total number of operations in the state that have a beef cattle herd
- Total economic income from beef cattle
- Economic rank for beef cattle production (out of 50)
- Total state income from agriculture
- Number of operations with Internet connection and type of access
- Economic classification ranges for state beef cattle operations
- Number of beef cattle farming and ranching operations
- Number of feedlot operations
- "Experience Score" average age of primary operator + average number of years that primary operator was working at the operation

Further definition of these demographic components and how they were accessed and other notation about the data sets are available in the appendix Table A.4.

In the next part of the process all the retrieved resources were read. The researcher marked the topics, the type, the format, the characteristics of information quality, the interactivity, and a measure of relevance according to the definitions established in the codebook for each piece of content that was archived for all the states. Every document link and title was recorded. Any issues and miscellaneous observations were recorded in a designated note area.

Finally, after each state, the researcher added to the contextual understanding of the material by assessing a measure of the perceived level of regulation that the state communicated via the content. The researcher based this measure on the communicated aspects of regulation giving a numerical score of one through five to address a spectrum of legislative control. A level five is the highest amount of perceived regulation and a one is the lowest with no discussion of regulations, explicit guidelines, or incentives to adopt identification or traceability practices. This is an important element to assess when it comes to equity of information because the communication of regulatory practices may or may not be congruent with the actual level of legislation. It may also influence the information needs and behaviors of the users in that state. The definitions of the ranks are described in greater detail in chapter 6 and are available in the appendix A.5.

Addressing Reliability

The researcher recognizes the importance of inter-coder and intra-coder reliability in demonstrating the overall quality of the methods. Given the scale of the project in conjunction with limited time and funding, the researcher was constrained to demonstrating this through an abbreviated test with a volunteer. Because the researcher was the main analyst in the process, the testing included a score for intra-coder reliability to assess the difference in the analytical perspective from beginning to the end.

The pilot study performed before the full data collection began was an opportunity to test the reliability of the measures and the codebook procedural definitions with another individual. The researcher randomly chose two states that were very different in size and region, Connecticut and Colorado, and coded all measures for the first five resources for the Connecticut Department of Agriculture and the last five resources for the Colorado State Extension results. The volunteer analyst was given the identical codebook with identical instructions and coded the same content that was gathered through the initial collection process. To address the intra-coder reliability the researcher came back to the same pilot study results post analysis of all other states and used the same pilot study test resources to perform the same coding as was done in the inter-coder testing with the volunteer.

For both reliability tests the researcher used Cohen's Kappa. Using this measure, where the results generally fall between zero and one, the smaller value means that coder agreement is more by chance and the larger value shows greater reliability between the two coders (Landis & Koch, 1977). The researcher used SPSS to calculate the values. The inter-coder reliability measures for the two coders was found to be Kappa = 0.46 ($p < 0.001$). Landis & Koch (1977) consider this a moderate level of agreement. As expected, the intra-coder results were slightly more reliable where Kappa = 0.68 ($p<0.001$). This is considered substantial agreement.

Phase 1 - Data Analysis

After all the data was collected for the two state information channels for all the states, the analysis used spreadsheets and the calculation functions in Excel to calculate descriptive statistics for each information channel and for each state as a whole. Each information topic was counted according to the total coverage in the state as a sum of the smaller units that make up the category, and as a percentage of the total potential for the state for that measure. The same numbers were charted in proportion with all the other states. The same procedure will take place for the types, topics, formats, and relevance. Information quality and interactivity are quantified according to the overall sum score of properties within the checklists for each, as well as with a percentage of each individual measure out of the potential total for that measure for the state. For example, if accuracy and authority are both information quality components and a state scores a fifteen on accuracy and a twelve on authority the analysis results included both the total 27 as a score for quality but also compared the fifteen and the twelve with the fact that the total score for each of these measures is twenty. The state percentage for accuracy is then 75% and the percentage for authority is 60%. Both sum scores and individual property percentages are viewed in proportion with these levels for all the other states.

These summaries are then presented in charts for discussion and further visualization with the state demographic components. It is important to note that in the process to total and compare the components of the content analysis, the researcher

needed to normalize the values for the different units before comparing them. For example, topic x has five elements that define it and topic y has seven. In order to get an accurately comparable value the researcher used the percentages to compare across the topics when the amount of units that make up the constructs varied.

After the results were tabulated and the charts were created for the results of the content analysis, the researcher looked at the levels of performance among the states holistically. For each item, each state had a score and the researcher ranked the states by these scores: one being the best and the higher numbers being the lower performers. By creating a table and summing across the ranks for topic coverage, information quality, interactivity, and relevance the results give a picture of the overall performance of the states prior to comparison with the demographic data. Information types and information formats were left out of this independent performance measure because by definition they are dependent on specific contextual understandings to assess the utility and quality of what the resources offer.

The next portion of the analysis took into consideration these contextual understandings. In order to see the relationships between the content and the information seekers within the state, the researcher first made a list of basic items that all the websites should provide. Then the researcher took each of the demographic data categories: amount of operation, economic income, Internet access, type of operation, experience (age and length of time on the job), as well as the perceived level of regulation for the state, and developed hypothetical statements that characterize

positive relationships between the context of the state and the information resource. These statements provide a basis and an example. The benefit of the comparison process with the hypothetical statements is that there is no limitations. Information professionals may have more specific relationships to test, yet these are the most salient for the research at hand given the understanding of the issue as developed in the first two chapters. After creating these statements, the researcher devised a system for comparison called the tier system that allows states to be evaluated based on their level of need expressed in the demographic data. An explanation of the tier system process is addressed in depth in chapter 6.

Network Analysis

Phase 2 – Data Collection

This phase begins the network analysis and resource visualization component of the research. The data for this phase of the analysis was collected during the content analysis. These are the external hyperlinks from each retrieved resource for each state. The collected hyperlinks are the URLs for external links only that addressed content related to any of the search terms. Broken links were noted, but not included in the final data set. Links to PDF documents were noted, but not included in the final data set. The data sets were created by establishing the edges or the relationships from the state nodes to their hyperlinked resource. State websites are listed as source nodes and target nodes are the external resources. This specifies that the network is directed. Each node was also classified according to the role or origin of the website. This means that

each node received a label: state Department of Agriculture, state Extension, state association, national association, international association, federal agency, corporation, publication or journal, research institute, and individual. These classifications were created at the discretion of the researcher based upon an understanding of each websites' primary mission and affiliation.

Phase 2 – Data Analysis

The data analysis portion for phase two consisted of creating visualizations using the open source social network analysis software *Gephi* (Bastian, Heymann, & Jacomy, 2009). Upon entering the data into the program the researcher used a visualization algorithm called Force Atlas to organize the connections into a viewable configuration. Force Atlas is a force-directed graphing technique created by the makers of *Gephi* to depict nodes in a way that takes into account the relationship to other nodes, not just the singular characteristics of the node. Additionally, it arranges for the least amount of crossed connections as possible. The edges are closer in length to each other than they might otherwise be in different algorithms (Bastian, Heymann, & Jacomy, 2009).

After running this algorithm the researcher applied another algorithm that adjusted for better visualization of the text labels with some further manual arrangement of nodes to show the networks and pattern created with as much clarity as possible. The researcher prepared two different visualizations that are discussed in greater depth in chapter 7. The first uses colors to depict the role or type of the node and the size of the node shows the in-degree, or amount of source nodes that link to the

node as target node. Source nodes (states) then had the smaller nodes. The second visual looks at the out-degree of a node, using color to depict the outward linking capacity of the source nodes. Node size represents the same property (in-degree) as in the previous visual. The researcher captured as many views of each network as possible for reporting and discussion of the results in chapter 7. In the final portion of the analysis in chapter 8, the researcher looked across all the previous measures of performance to name the states that are highest ranked overall the categories.

This chapter, chapter 4 addressed the two phase process that the researcher took in order to answer the four research questions. Chapter 1 introduced the issues that drive this inquiry and stated the four specific questions that the research answers. Chapter 2 provided an in depth review of the literature from multiple disciplines that forms the basis from which the theory and the methodology for this study emerge. Chapter 3 explained the theoretical components of the newly created CIAV model that drives the research design. The following chapters 5, 6, 7, and 8 will report and discuss the results for each of these questions. Chapter 5 addresses research question one, chapter 6 addresses research question two, chapter 7 addresses question three, and chapter 8 addresses question four. The reporting of these results leads to a deeper discussion in chapter 9 about the implications and suggestions that make this research meaningful for different scholars and professionals in practice. Chapter 9 also includes three use case scenarios to help situate the findings within future applied contexts.

Chapter 10 concludes the research with a look at some limitations and many plans for future work creating a body of research that emerges from these initial results.

CHAPTER 5 - INFORMATION RESOURCES: RQ 1 RESULTS

The previous chapter discussed the methods used to collect and analyze the data for the first phase of the research. The following two chapters will address the results for research questions one and two respectively. Chapter 7 will follow with a large portion devoted to discussing the results for research question three. Chapter 8 will address research question four by looking at the overall performance, which will take the reader into the discussion section in chapter 9. In the current chapter 5, the researcher presents findings from the content analysis process and uses multiple visuals to explain and consider results that answer the first research question about information resources.

Research Question 1

What information resources are accessible for each state?

Accessible resources are more than just available resources. In order to best understand the accessibility of the resources available the researcher addresses the need to look at information topics, types, and formats, as well as information quality, interoperability, and relevance measures. All of these measures play a role in the characterization of accessibility for each state.

Guides for Looking at the Charts:

The amount of data and information processed in order to communicate answers to each research question requires the use of multiple chart types and abbreviations to make the views concise and complete. In order to facilitate

understanding of the visuals and discussion the following tables 5.1, 5.2, and 5.3 are guides that disambiguate the abbreviations and clarify content viewed within the tables and figures to come in chapters 5, 6, 7, and 8.

Table 5.1 State Abbreviations

State	Abbr.	State	Abbr.	State	Abbr.	State	Abbr.
Alabama	AL	Indiana	IN	Nebraska	NE	South Carolina	SC
Alaska	AK	Iowa	IA	Nevada	NV	South Dakota	SD
Arizona	AZ	Kansas	KS	New Hampshire	NH	Tennessee	TN
Arkansas	AR	Kentucky	KY	New Jersey	NJ	Texas	TX
California	CA	Louisiana	LA	New Mexico	NM	Utah	UT
Colorado	CO	Maine	ME	New York	NY	Vermont	VT
Connecticut	CT	Maryland	MD	North Carolina	NC	Virginia	VA
Delaware	DE	Massachusetts	MA	North Dakota	ND	Washington	WA
Florida	FL	Michigan	MI	Ohio	OH	West Virginia	WV
Georgia	GA	Minnesota	MN	Oklahoma	OK	Wisconsin	WI
Hawaii	HI	Mississippi	MS	Oregon	OR	Wyoming	WY
Idaho	ID	Missouri	MO	Pennsylvania	PA		
Illinois	IL	Montana	MT	Rhode Island	RI		

Table 5.2 Other Abbreviations / Organization Acronyms

Term	Abbr.
State Department of Agriculture	DOAG
State Extension	EXT
Animal and Plant Health Inspection Service	APHIS
United States Department of Agriculture	USDA
Animal Disease Traceability	ADT
International Standards Organization	ISO
National Agricultural Statistics Service	NASS
North American Industry Classification System	NAICS
Radio Frequency Identification	RFID
Digital Subscriber Line	DSL
Bytes Per Second: Kilo, Mega	BPS, KBPS, MBPS
Portable Document Format	PDF
Hypertext mark-up language	HTML
Microsoft Excel documents	XLS, XLSX
Microsoft Word documents	DOC, DOCX
Microsoft Power Point documents	PPT, PPTX
Rich Text Format	RTF
Text File	TXT
American Standard Code for Information Interchange	ASCII

Table 5.3 Phase 1 Chart Reader's Guide

Construct	**Definition**
Average Percent of Total	Each resource has a potential to score 20 points for each element within the lists of topics, types, formats, information quality components, interactivity, and relevance. When one sees the "average percent of total," this is an average score out of 20 for *that measure* across all fifty states. Ex: the topic of research = 4% total on average. On average the states' 20 retrieved resources talk about research 4% of the time.
Stacked Bar Graphs	All stacked bar graphs represent a break-down of the smaller components of a measure by the state. The largest average percent of total is on the bottom of the stack and the smallest is on the top.
Ordering of States	States are always in alphabetical order by abbreviation.
Ordering of Elements	Elements are always shown in order from least to greatest.
Ranks	Based on the score of the element the states are ranked 1st to last depending on the number of repeating scores for that particular element. The lower the number, the better the ranking.
Steps to Construct the Table Tiers from the Ranks	Step 1: Sort the scores from least to greatest i.e.: best to worst Step 2: Obtain the median score Step 3: Divide the states into five portions with the middle portion surrounding the median. Each portion will range between about 8 and 12 states and divisions should be logically placed between a point spread of 0.5 or greater.
Tier Color Significance	Green = Top tier Blue = Second tier Grey = Middle tier Yellow = Fourth tier Pink/Red = Bottom tier
Three – Tier Contextual Comparison Color Significance	Green = Top tier (High performance) Yellow = Middle tier (Average performance) Pink/Red = Bottom tier (Low performance)

Prevalence of Regulatory Information and Programmatic Discussion in Subject Matter

Starting with the ten information topics designated as integral components to discussions of cattle identification and traceability, the results of the content analysis show that the overall greatest focus of the websites is on the two topics: guidelines and regulations and programs, events, and opportunities. When one sees the results "average percent of total," in a discussion, this is an average score out of twenty for that measure across all fifty states. The number is twenty because for each website ten results are assessed. Ten for the state Department of Agriculture and ten for the state Extension website. Figure 5.1 shows the average percent coverage of each information topic for all fifty states. This means that on average the state resources cover each of these information topics in a range from 22% of the total resources for guidelines and regulations at the top, and at the bottom, dispelling myths and misinformation is only covered one percent out of the total twenty resources. Research is also seldom covered by any of the states with only four percent on average out of the total resources overall. Another score to note is that the average degree to which information about security, disease, and risk topics are covered is lower than one might expect with thirteen percent. This is even with coverage on the topic of technology and methods of identification.

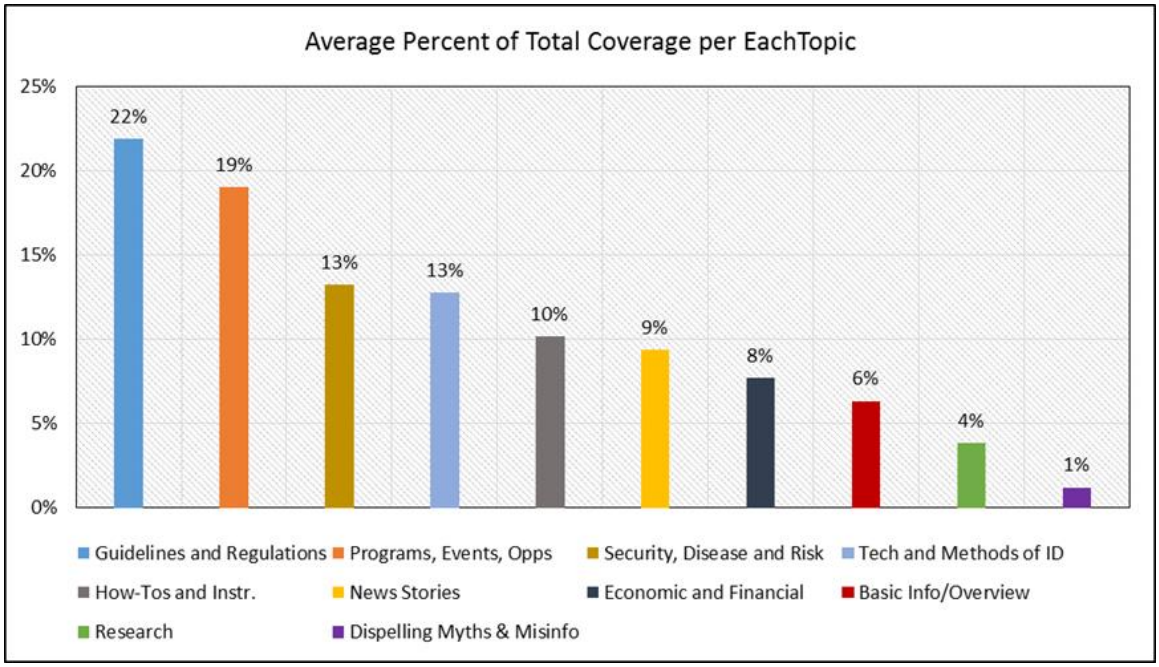


Figure 5.1 Average Percent of Total State Coverage for Each Information Topic

One might expect guidelines and regulations to be the dominant topic covered given the role of the Department of Agriculture in legislative practices for the state and Extension's role in outreach to the state producers on all types of information related to agricultural production and life. Less expected is the lack of basic information available from states overall. Could it be the case that the conceptual overview is viewed by the information providers as not needed because this information is obtained elsewhere or is part of the general body of knowledge for most producers? This assumption may not actually be the case. For example, McBride & Matthews' (2011) survey of small scale producers noted that during the period of the NAIS voluntary period, a quarter of the cow-calf operations in their study with twenty cattle or more were unfamiliar with the system.

Coverage of financial and economic considerations is also surprising because financial concern for the preservation of one's business and the sustainability of one's personal livelihood is often what drives the behaviors and attitudes of the cattle producer. The very small amount of discussion about myths and misinformation overall is also problematic. Traceability and identification practices are hotly debated by many different stakeholders and many exaggerations, unsubstantiated claims, and perspectives among the discussions create many different ways to understand the situation and in many cases the dialogue may not be very accurate. These two state resources have the opportunity to speak authoritatively about certain risks and benefits

and yet the majority of the resources rarely address false claims and other contested issues.

As expected certain states cover specific information topics at a greater level than others. Seeing the top states for each of these topics together allows for a view of the specific areas where certain states direct their focus, but it also gives a glimpse of those that have a larger overall level of topic discussion in multiple areas. Table 5.4 shows the top ten scoring states for each information topic based on the average level of coverage for that topic. Kansas, Washington, and Michigan appear at the top of each list often. Colorado, Utah, and Iowa also appear frequently.

Table 5.4 Top Ten States by Information Topic Coverage

Rank	Guidelines & Regs.	Programs & Events	How-Tos	News	Tech & Methods	Research	Econ.	Basic Info	Dispelling Myths	Security, Disease, Risk
1	MI	WA	MI	WA	KS	KS	KS	KS	OR	CO
2	LA	IN	AL	CO	MI	IL	CA	FL	KS	ID
3	WA	OR	MD	IA	AL	IA	MN	MN	IL	OR
4	MO	CO	CO	ID	IA	WA	SD	ND	MI	MN
5	IA	ND	MN	OR	VA	ID	UT	OR	NM	WA
6	KS	TN	KS	WI	UT	CA	ND	MI	TX	AL
7	NV	VA	LA	MO	WA	HI	OK	WV	CA	VT
8	WI	IA	MO	TX	MN	NM	TN	ID	IA	KS
9	ID	WI	NC	AL	NC	OK	WV	IA	MN	RI
10	UT	NH	DE	NV	ND	WY	FL	LA	MS	ND

Breaking Down the Information Topics Shows Nuances in State Focus and Illuminates Areas of Inattention

The following section breaks each information topic down by state percentages in order to compare the actual coverage levels for each topic per state. Doing so

provides a clearer understanding of topics that are missing or have little coverage in specific states. Additionally, looking at the percentages of the smaller units of measure that define the larger topic construct shed light on the more detailed underlying elements shaping that information topic. In order to legibly and effectively view these smaller percentages, the figures show the percentages of the top ten states for each specific topic referencing the top ten list shown in table 5.4. This provides an overview of the states that deliver the most content on the topic overall and gives a snapshot of defining factors that will ultimately be echoed on a smaller scale by those states less heavily engaged in discussion on that topic.

Guidelines and Regulations

Figure 5.2 shows the breakdown by state for guidelines and regulations. For this first and most covered topic Michigan has the highest coverage with 45% and Montana has the lowest with one percent. The majority of states have about 20% coverage. It is interesting to note that states known for large amounts of cattle production are not necessarily the states with major coverage of this topic. Texas is a good example of this. For a state such as Alaska; however, this lower coverage may be expected given the small amount of production and climate considerations that make a high level of production impossible.

Looking at the item breakdown for guidelines and regulations in figure 5.3, the graph shows that the top ten states are generally talking about state and federal rules,

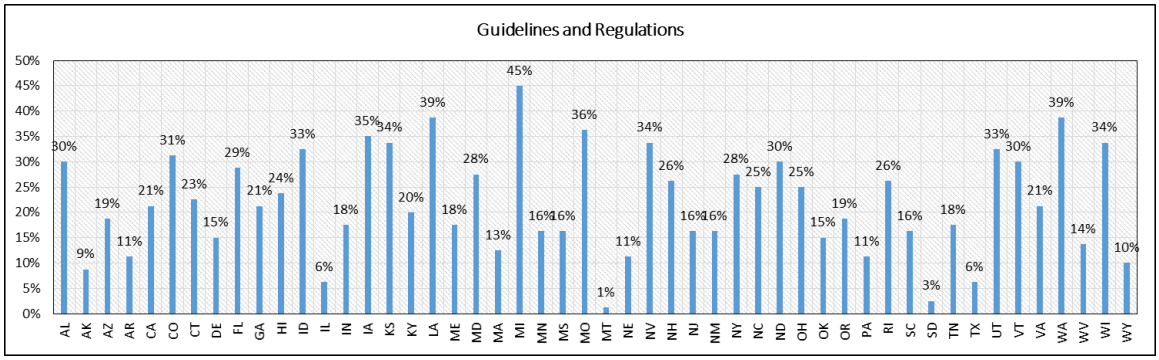


Figure 5.2 Guidelines and Regulations Percent of Resource Coverage Out of the Total 20 Possible

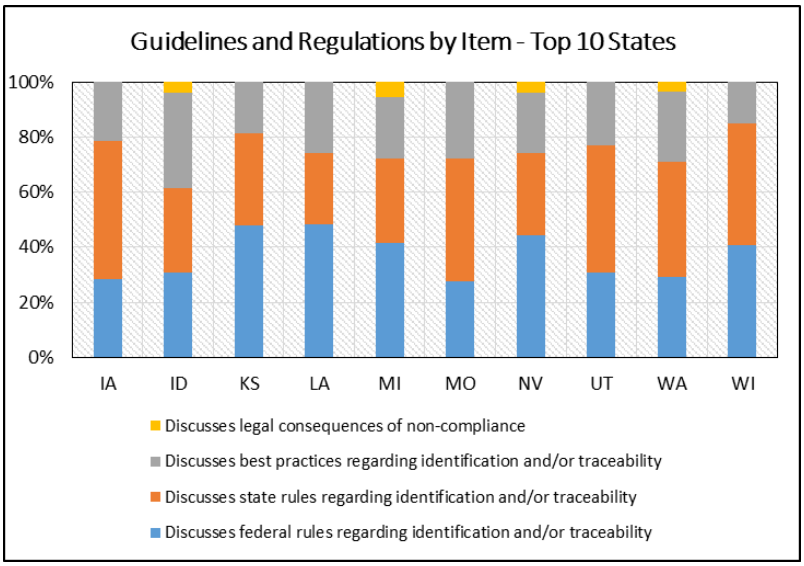


Figure 5.3 Guidelines and Regulations by Item for the Top 10 States

with slightly less coverage of best practices. Very little if any discussion is happening regarding legal consequences of non-compliance. This lack of discussion of legal consequences of non-compliance is important to note because of what this absence communicates to users. Are there any legal consequences? If these are not clearly stated what incentives do skeptical producers have to ensure that they are in compliance? Also one might question if these consequences are different depending on the state. Finally one may notice in the coverage of the guidelines and regulations that specific attention is placed on addressing whether the new regulations are state or federally mandated. This treatment of the discussion communicates an important message to the user about the locus of power in governing the state's activity.

Programs, Events, and Opportunities

Programs, events, and opportunities coverage levels shown in figure 5.4 have slightly less coverage than guidelines and regulations. The top coverage comes from Washington with 38% and the lowest amount of seven percent is seen in three states: California, Massachusetts, and New Mexico. The majority of states have a coverage percentile in the high teens. The fact that each state has some coverage of this topic suggests that each state does have activities and opportunities to engage producers and others about the topic perhaps through seminars, training sessions or workshops. Looking at the item breakdown for programs, events, and opportunities in figure 5.5, the graph shows the majority of the discussion is either about institutional purpose

Figure 5.4 Programs, Events, and Opportunities: Percent of Resource Coverage Out of the Total 20 Possible

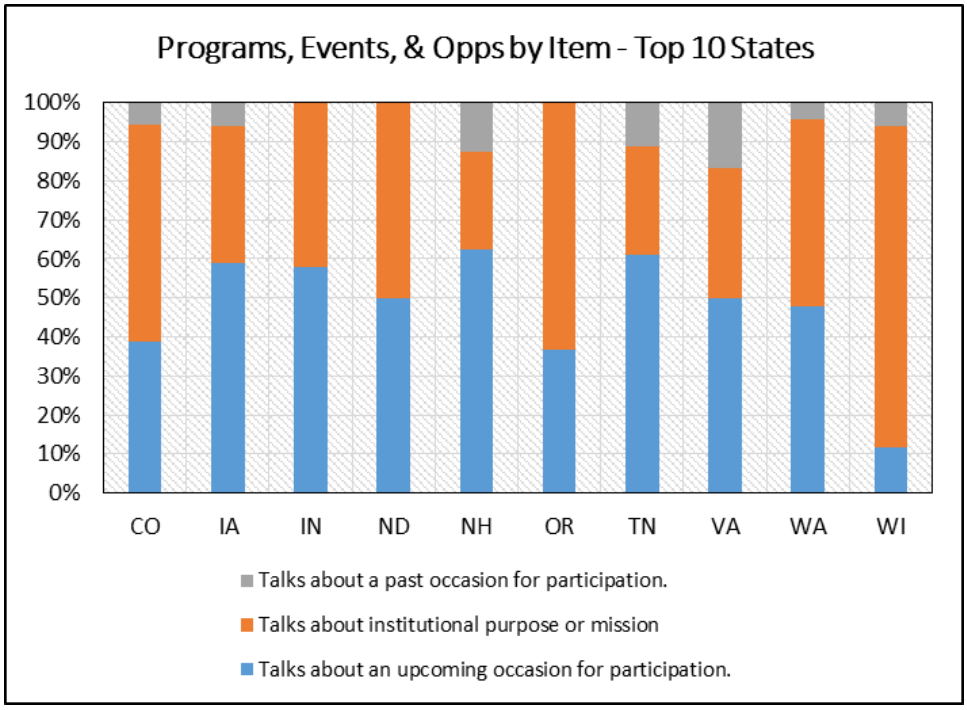


Figure 5.5 Programs, Events, and Opportunities by Item for the Top 10 States

or mission or an upcoming occasion for participation. Very little discussion talks about past events. Wisconsin has a large amount of institutional purpose discussion and New Hampshire has a large amount of program and event coverage. The imbalance that these measures show communicates a lot about activity and participation.

One would hypothesize that in states where there is a high amount of institutional purpose and mission discussion and little talk of upcoming programs that there is a lot of separation between the governing/research oriented entities and the producers themselves. There may be a lot of talk activity, but it is not open for participation.

Conversely little discussion of institutional purpose with lots of events may be cause to believe that there is less structured discussion about the goals of the activity. Past event discussion may be a result of poor currency of the website, but at the same time it shows a history of efforts to work with producers on the issue.

Security, Disease, and Risk

The topic category of security, disease, and risk shown in figure 5.6 has a diverse range of coverage across states with one state scoring much higher than the others. Colorado has the highest amount of coverage with 43%. Montana has the smallest amount with two percent. The majority of the states have a level of about eleven to twelve percent. This topic is similar to both economic and financial and basic information topics where it seems that the states should have more overall coverage.

It is concerning that Montana has such a low amount of coverage considering that they share a large border with Canada and potentially see a lot movement across

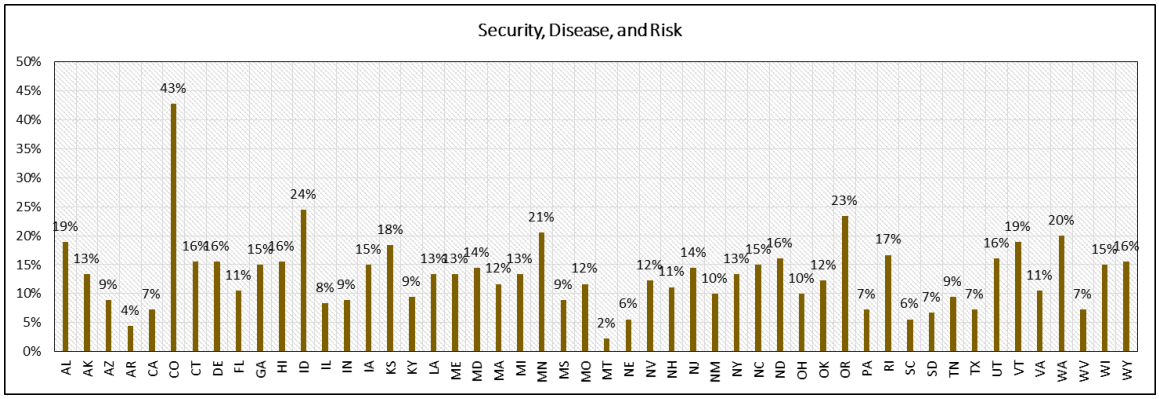


Figure 5.6 Security, Disease, and Risk: Percent of Resource Coverage Out of the Total 20 Possible

the border. Colorado's large amount of coverage may be due to their larger amount of operations, perhaps in conjunction with an outbreak of particular illness in the region. Many of the states have biosecurity information that has to do with their state's specific needs and past experiences with diseases.

It is rare for a state to mention agroterrorism. All the top states shown in figure 5.7 address both operation-based biosecurity measures and national biosecurity measures. Less discussion is given to consequences of disease and states barely touch on the issue of the risks surrounding loss of privacy. Washington is the single state that addresses each item at least a small amount. One may wonder why states have little to no information about agroterrorism. It might be that there is fear that speaking about the issue would cause public unrest and consumers would become more hesitant in their choices to buy beef and/or more insistent about requiring greater transparency of all producer practices. Perhaps there is the perceived threat that discussion may put ideas into the heads of malicious individuals? It should be noted that the lack of discussion about consequences of an outbreak is similarly low, which may be indicative of a state's need to stay away from generating fears and suspicions in any information seeker. While there is more discussion about emergency measures there is still a lack in two of the top states. Every state should have some emergency resources or plans in place and as the research has shown elsewhere in the results. The most common concern as discussed in the literature (privacy) was underrepresented throughout the states. This absence can serve to perpetuate producer uncertainty about the issues.

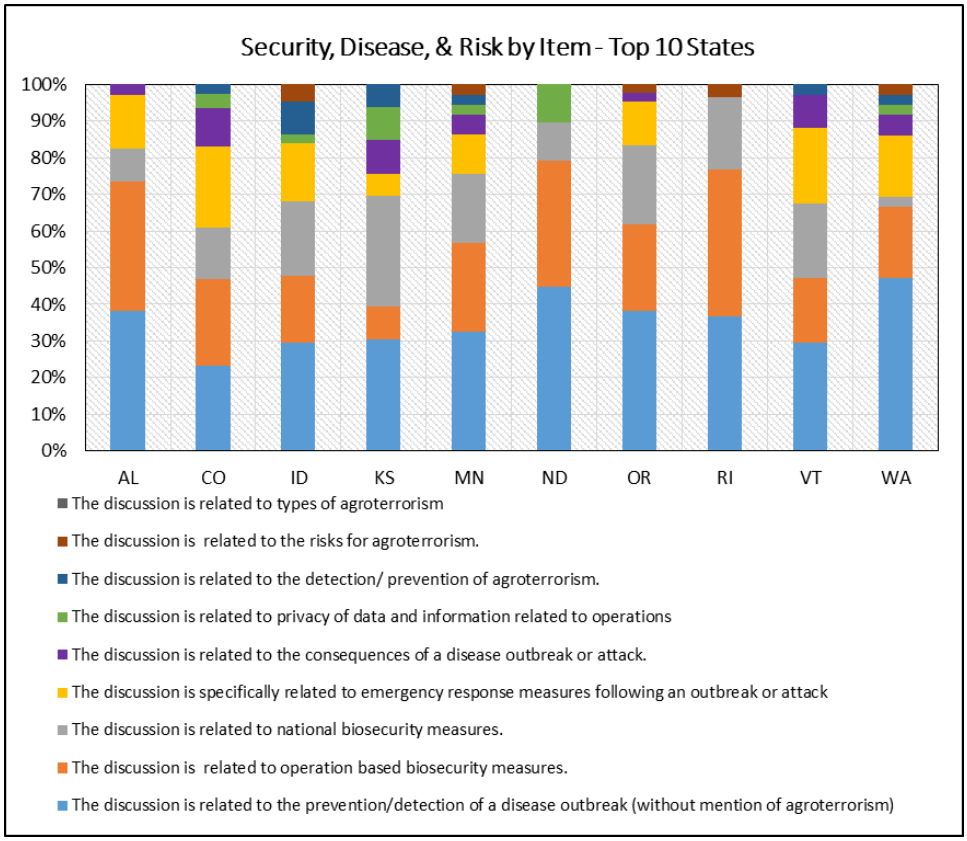


Figure 5.7 Security, Disease, and Risk by Item for the Top 10 States

Technology and Methods of Identification and Traceability

The information topic of technology and methods of identification and traceability shown in figure 5.8 is the third most covered topic on average. Kansas has the most discussion with 31%. Texas and Indiana have the lowest scores with no coverage in this area. The majority of the states have around eleven percent.

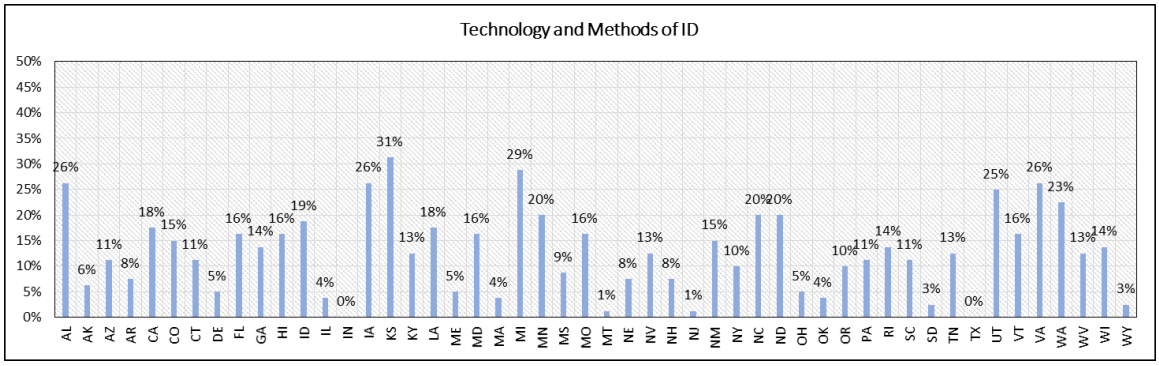


Figure 5.8 Technology and Methods of Identification and Traceability: Percent of Resource Coverage Out of the Total 20 Possible

Again Texas is one of the lowest providers of content on this topic. This may be a reflection of the large amount of very small scale operations in the state; however, it may be considered an example of an information disparity and should not be left out of the discussion altogether. Another factor in the lack of discussion may be that in many states the choice of identification and traceability type may be a very personal or cultural decision. This sentiment is reflected in the ADT final ruling decision to accept multiple types or methods of identification such as brands and tattoos depending on the state policies.

Looking at the itemized breakdown of technology and identification methods for the top ten states shown in figure 5.9, it becomes clear that the majority of the discussion across the board focuses on technology used for traceability. All the top states also have average coverage of the ways that traceability is executed. Minnesota is the one state that addresses ways of identification only. A few states have a minor amount of information covering technology that is used only for identification.

The overwhelming discussion of traceability over simply on-farm or ownership based identification methods makes sense given the final ruling on traceability. The information about technology is often about ear tag types and/or discussion about what types of identification are compliant with traceability measures and effective record keeping.

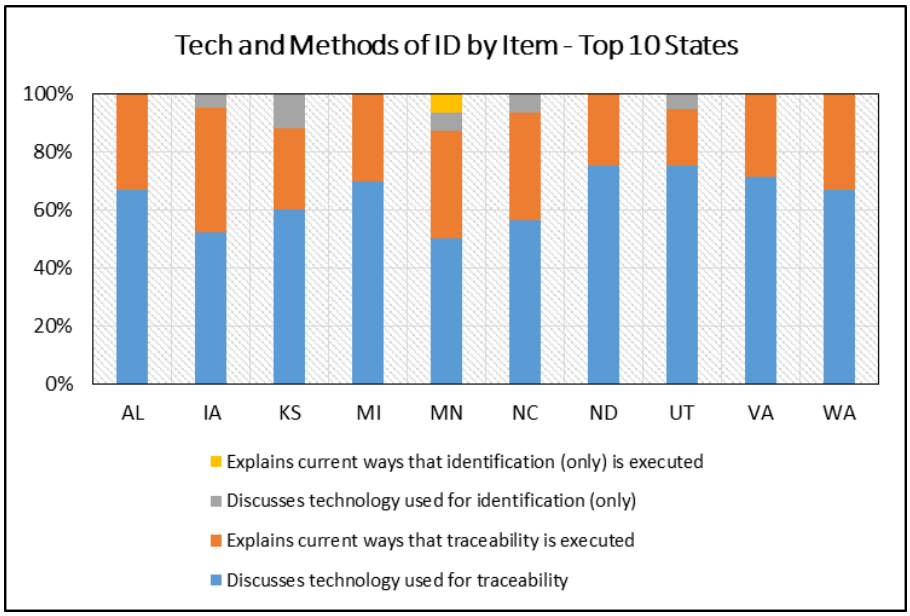


Figure 5.9 Technology and Methods of Identification and Traceability by Item for the Top 10 States.

How-Tos and Instructions

The information topic of how-tos and instructions shown in figure 5.10 has a medium amount of overall coverage with the highest being Michigan at 26%. The lowest states are Illinois, Texas, and Wyoming each with one percent. The majority of the states cover it about ten or eleven percent. It is important to recognize the lowest states for this topic also have some of the highest incomes from beef cattle or the greatest amounts of operations. Texas is high in both.

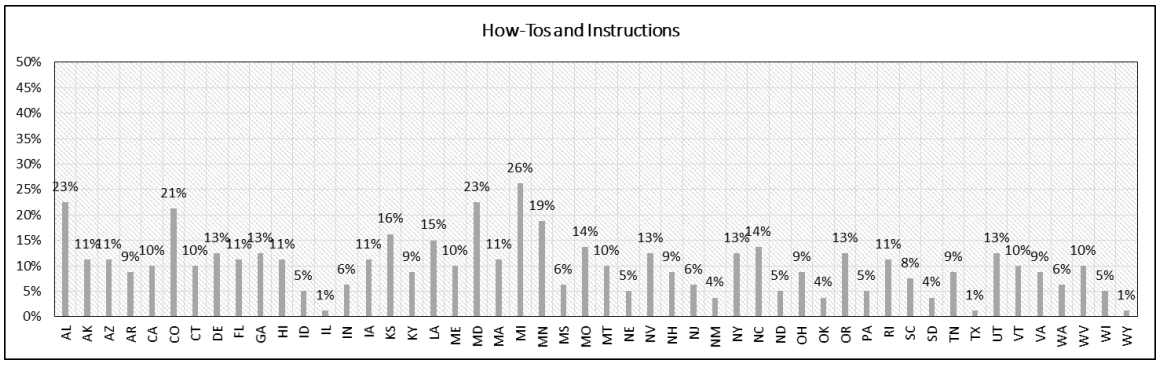


Figure 5.10 How-Tos and Instructions: Percent of Resource Coverage Out of the Total 20 Possible

Having very little resources, as seen in the case of Texas, means that there are a lot of producers out there who may not know the ins and outs of identification and traceability implementation and will continue to be without knowledge of the process. These are also going to be the states where there is more risk for foreign animal disease to occur given the amount of operations. Having instructions available may be a major factor to facilitate action in compliance. The low level of instructional content overall is

alarming since it is a practical concern that every producer understand and know how to identify their cattle. Could it be that governing bodies and research entities believe that there is a high level of understanding of the process already?

Looking at the chart represented in figure 5.11 that breaks down the how-to and instruction topic items, one can see that the most coverage comes in the form of instructions about the process. This is the only item that Missouri covers. There are other specific instances where states have a lot of 4-H and youth educational resources. Delaware and Maryland are good examples of this. Michigan has a large number of fact sheets about the identification process.

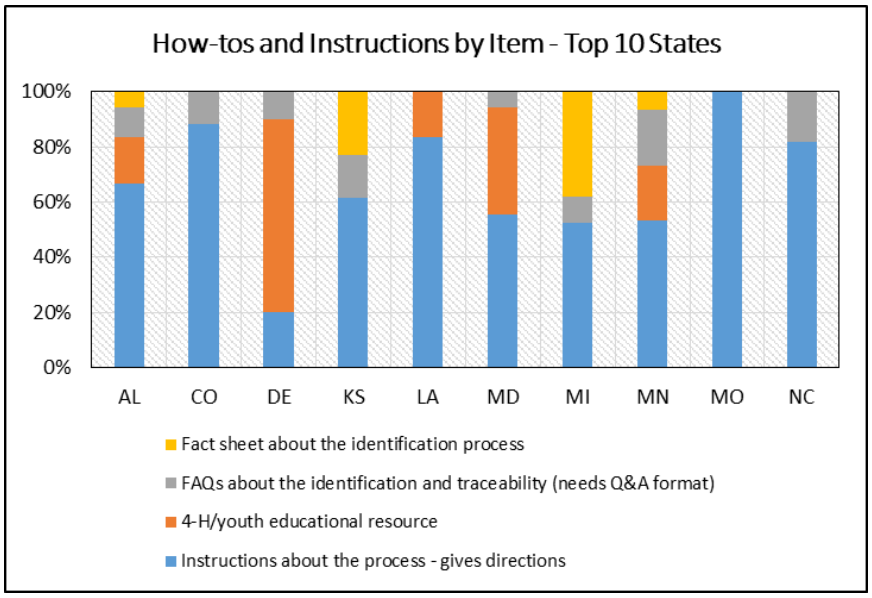


Figure 5.11 How-Tos and Instructions by Item for the Top 10 States

These scores show less attention to frequently asked questions (FAQs) which causes one to ask whether there are opportunities within the state information

infrastructure for individuals to ask questions; however, the lack of FAQs may also stem from the lack of overall involvement in complying with identification or traceability. In several occasions the 4-H resources dominate this topic area. While these resources are important, one questions their position within the general search for the cattle producer and other public stakeholders. Would these be effective modes of instruction for everyone? In many cases the resources seemed to be limited to competition/show standards and fairground requirements.

News Stories

The coverage of news as shown in Figure 5. 12 is slightly lower than how-tos and instructions. The highest amount is provided by Washington at 24% and the lowest is Arkansas at one percent. The majority of the states have about eight or nine percent coverage.

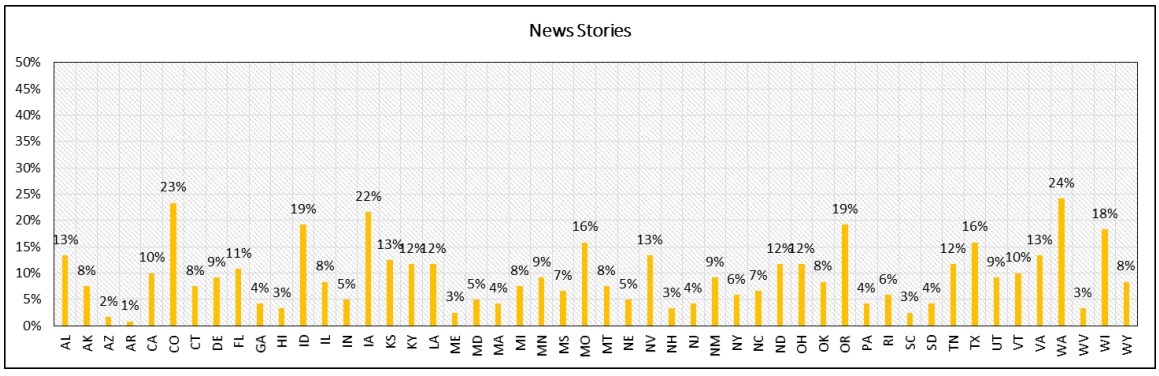


Figure 5.12 News Stories: Percent of Resource Coverage Out of the Total 20 Possible

The amount of news coverage may be highly contingent on the currency of the website material and how often individuals are posting articles. Naturally, one might expect this topic to have less coverage simply because the focus of the entities are less about providing news and more about providing other resources such as regulatory information and education. In some cases the news stories appeared to double as an educational resource or to communicate about changes in regulation as well as highlight individuals who exemplify certain quality characteristics in their establishments and encourage others to do the same.

Looking at the itemized breakdown of the news topic coverage for the top ten states figure 5.13 shows that the majority of the coverage is local news with national news a close second. Very few states have interviews, editorial content, and historical accounts. There are some states however, that have some coverage of international news, specifically Texas and Iowa.

It makes sense that Texas has a larger portion of international news because of their border with Mexico. Iowa has a similar amount and one might guess that this has to do with their role within the production phase as a more feedlot oriented state. Operations would have an eye on the international markets. In a few cases local news played an interesting role in demonstrating the importance of identification where law enforcement counter-acted wranglers or caught producers who were not compliant. This could be an effective tool for other states to communicate the issue while putting a real-life application to the issue.

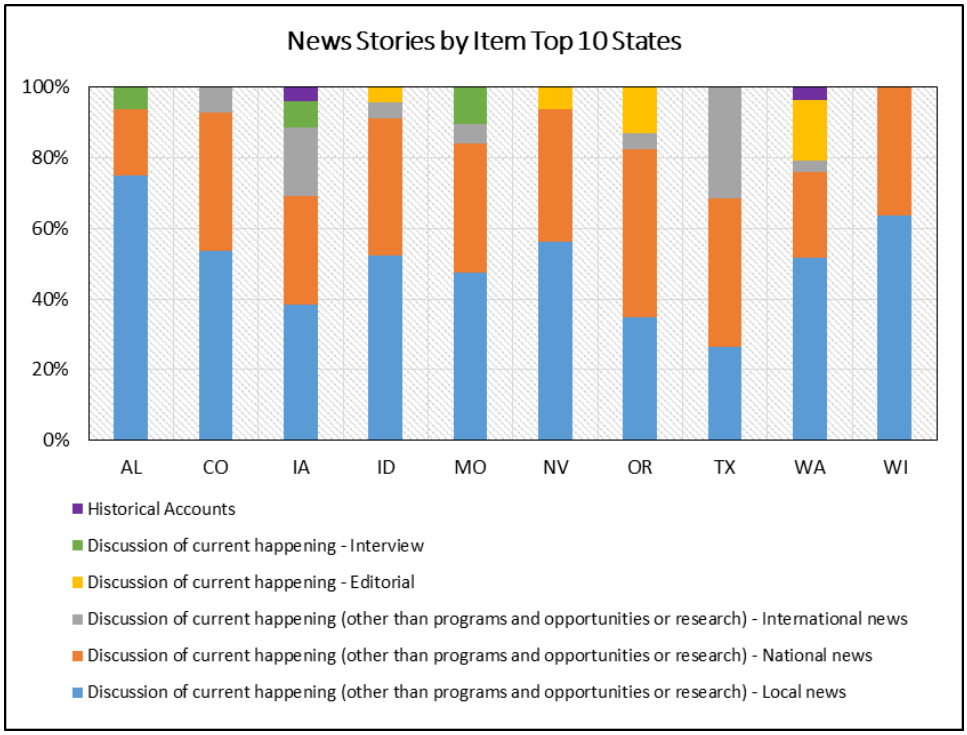


Figure 5.13 News Stories by Item for the Top 10 States

Economic and Financial

The category of economic and financial issues also has a diverse range of coverage levels. As is shown in figure 5.14 Kansas has the highest amount with 41%. There are four states at the lowest level with no coverage, including: Delaware, Louisiana, Massachusetts, and Rhode Island. Most of the states have around ten percent coverage.

The concerns of economic and financial issues are tantamount for most producers across the board, so it is interesting to see the wide range of coverage. Perhaps it should be higher in many cases given the concern that very small scale operations may have regarding the cost of implementation. States such as Texas and Wyoming have a large deficit in this area given the size of their small scale producer population. It will be hard to convince and assure this population in the interest of traceability when there are not resources that relate to the issues that are most important to them.

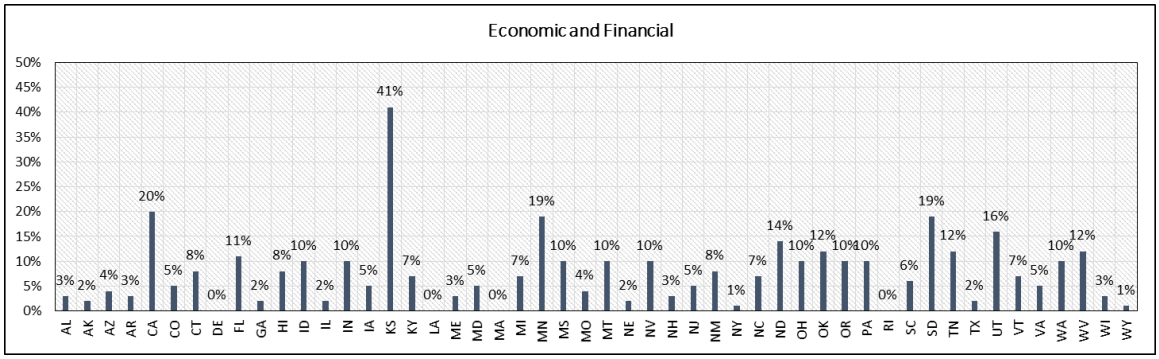


Figure 5.14 Economic and Financial: Percent of Resource Coverage Out of the Total 20 Possible

Looking at the itemized chart shown in figure 5.15 of the financial and economic coverage for the top ten states one can see that the majority of the states focus on issues of personal financial gain related to implementation. This is highest in Tennessee and West Virginia. All states cover issues related to market benefit from implementation more consistently. There is much less discussion of issues related to liability and also very little about affordability except for the coverage in Florida.

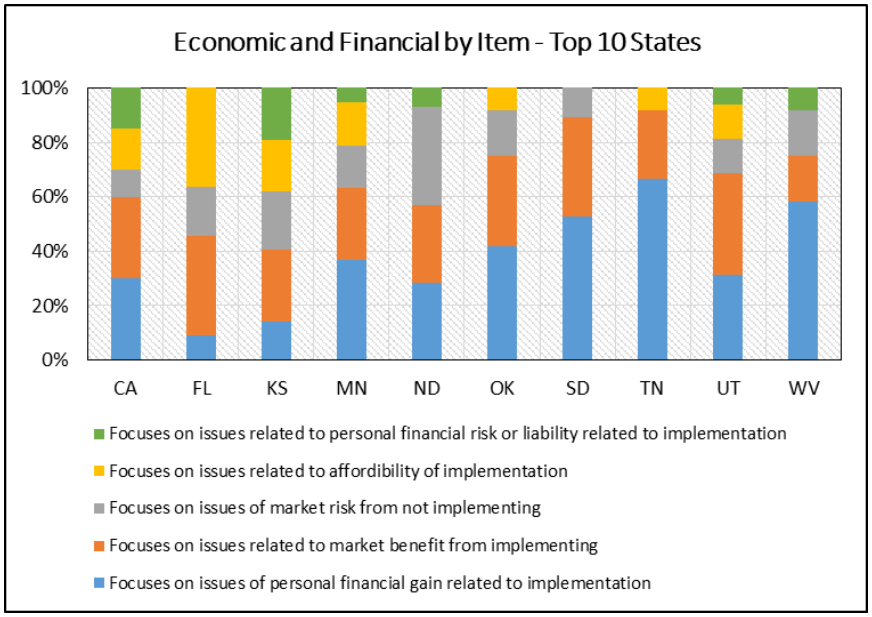


Figure 5.15 Economic and Financial by Item for the Top 10 States

It makes sense given the number of very small scale operations in Tennessee and West Virginia that they will have the most discussion of personal financial gain related to implementation. Many producers in these states may be looking for ways that they can increase revenue. This includes information on beef quality assurance programs. It

is important to note that the content areas so often neglected are the areas reported to be three of the biggest concerns to cow-calf producers: affordability, and financial risk and liability. It seems as though these are issues that need greater discussion across the majority of states given that these states are small-scale focused. North Dakota has an interesting amount of weight on market risk from not implementing, which may reflect an aspect of their state's market. For example, the state may be very active in national or international trade.

Basic Information and Conceptual Overviews

The basic information and conceptual overview information topic category shown by state in figure 5.16 is the third lowest ranking in topic coverage. The state with the most coverage is Kansas with 25% and there are three states with no coverage: Alaska, Maine, and Nebraska. Most of the states have five or six percent coverage.

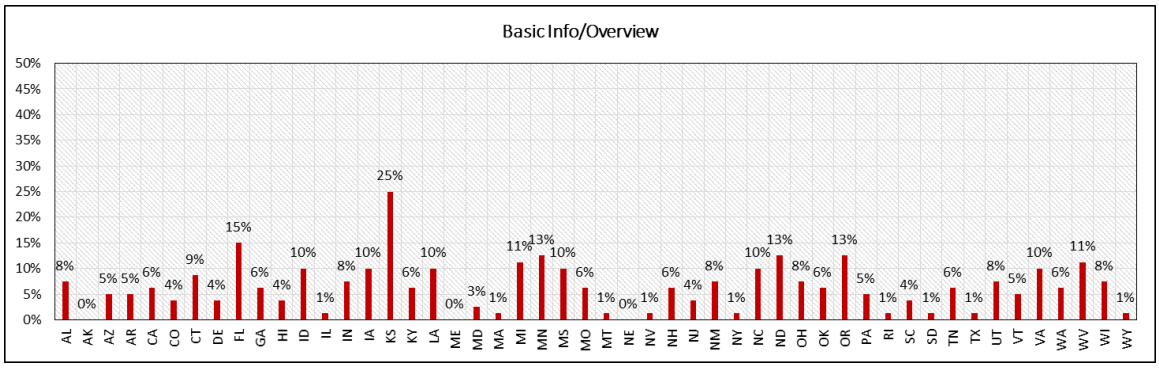


Figure 5.16 Basic Information and Conceptual Overviews: Percent of Resource Coverage Out of the Total 20 Possible

This topic, being the most basic of information to promote understanding about traceability, seems grossly under addressed. All states should provide at least a basic overview of the concept to their producers and information seekers because the subjects play such a large role in the new federal regulation. There may be specific information about the idea to impart to state producers. The low results make sense for two of the states that currently have no coverage (Alaska and Maine) as they are states that have a small amount of operations; however, Nebraska is known to be a large cattle producing state. It may be the case that experts assume that most producers are knowledgeable about traceability when they may not be. More discussion of this topic may help to bring a greater understanding of the motivation for implementation to everyone.

The breakdown by item of the basic information category for the top ten scoring states in figure 5.17 shows that the most covered item is introducing the rationale or the “why” of traceability for all ten states. Iowa is the only state that did not address the idea of traceability. There was a small amount of discussion about both the “what” and the “why” of identification from three of the states. It makes sense that the “why” of traceability is the most commonly addressed given the newly administered final ruling, but there is a lot less general definition of what traceability is. This should be covered to ensure that individuals can feel they have a full understanding of the process so that they can ask questions and make requests for help.

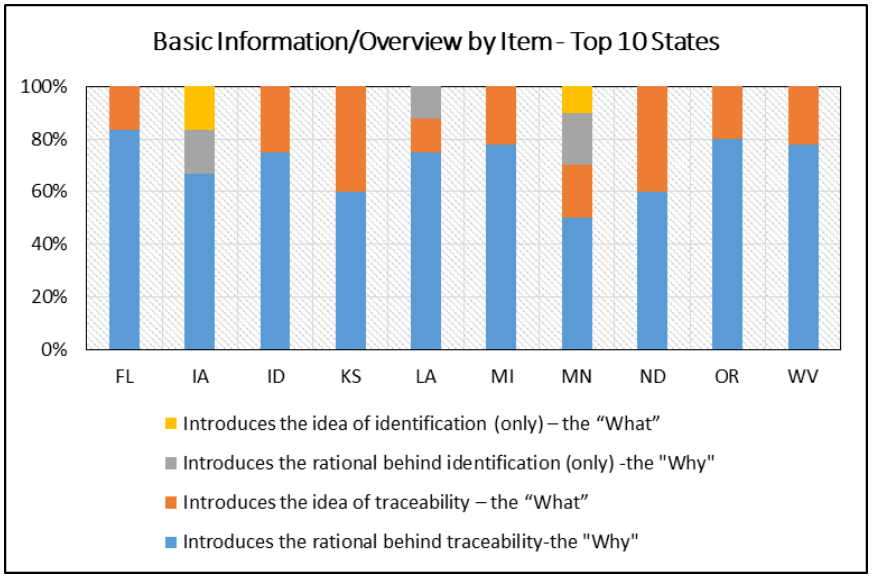


Figure 5.17 Basic Information and Conceptual Overviews by Item for the Top 10 States

Research

As figure 5.18 shows, coverage on the information topic research overall is very low. The state that has the most is Kansas with fifteen percent coverage. A large amount of states (eleven) scored lowest because they have no coverage. One and four percent seem to be the most common amounts of coverage. This is a significant overall deficit in research as an information topic. It makes sense that states such as Kansas and Iowa that have large research programs at the major land-grant institutions will have more research discussion. Other states may also benefit from this communication about research. One of the issues may be communicating about the research in such a way that is palatable for a larger audience. There may be limitations in how much time and resources can be allocated to this task.

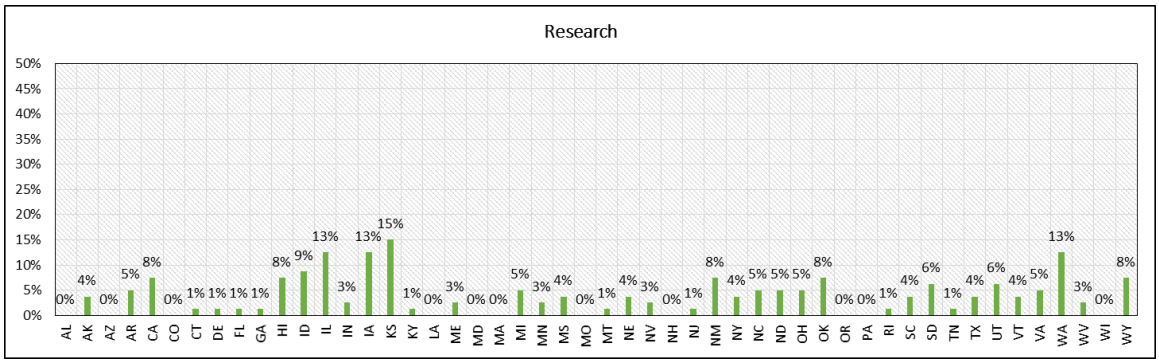


Figure 5.18 Research: Percent of Resource Coverage Out of the Total 20 Possible

The breakdown of the research information topic by item in figure 5.19 shows that the main discussion is about details from a scholarly study, sharing more than just

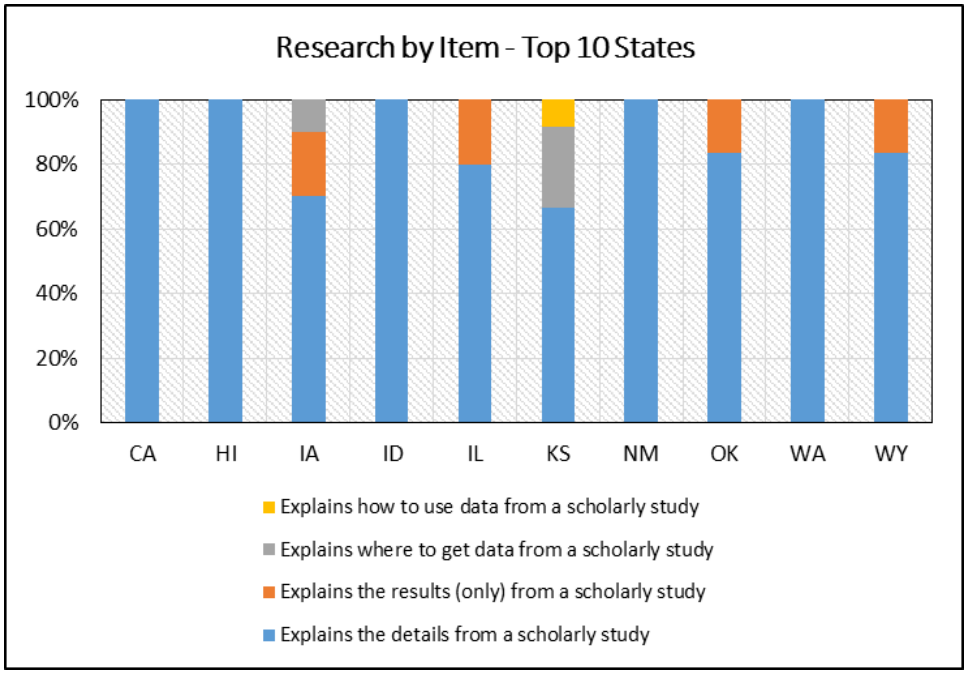


Figure 5.19 Research by Item for the Top 10 States

results or statistics. Kansas is one of the only states to explain not only where to get data, but how to use data. Iowa also explains where to get data. It is interesting to note that there is attention to explaining details from scholarly study when research is addressed. This suggests that the states are focusing on delivering not just facts, but are also interested in explaining the rationale behind the outcomes and the activities that created these results. In some instances the more detailed focus on gaining and using data by the producers may be indicative of states that have a data repository or certain projects that include producers in the research or at least open up data sets to interested users.

Dispelling Myths and Misinformation

Dispelling myths and misinformation is the information topic with the least amount of coverage in the resources retrieved. As shown in figure 5.20 Oregon scores highest with thirteen percent and the majority of states (36) have no coverage.

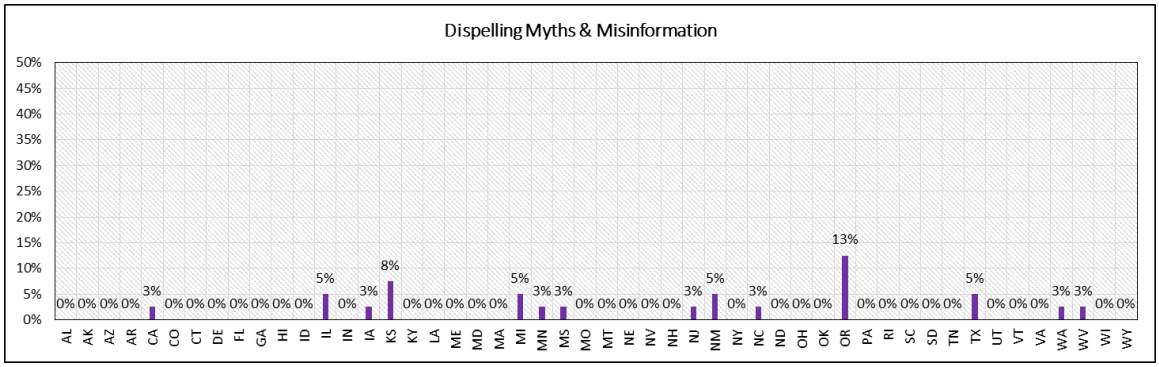


Figure 5.20 Dispelling Myths and Misinformation: Percent of Resource Coverage Out of the Total 20 Possible

There is heavy discussion by producers and stakeholders in online spaces about the good and the bad of cattle traceability as well as everything in between. Many have fears about certain aspects of federal regulation, especially aspects of privacy and liability. Just as with any controversial topic, the truth may often be stretched in the name of persuasion and debate. States are not doing much to counter myths or misinformation, at least not by addressing it head on. Part of this may be that there needs to be more of a dialogue with producers and information seekers. By addressing common misconceptions and quelling rumors, states may be able to shed some light as an authoritative voice. One might suggest that Oregon as the state with the most has a reputation as a progressive state which might contribute to the state's collective awareness of diverse voices and concerns from producers.

For the states that have a higher score of coverage in dispelling myths and misinformation, the itemized chart figure 5.21 shows that it is more common for the discussion to be on common misconceptions than it was to provide evidence to counter the misconception. These two items go hand in hand. It almost seems strange to think that one exists without the other. In several cases; however, resources will address a misconception without providing counter information. By making sure that these two elements exist in the resource, the classification of a discussion as misinformation will be better understood because the state is able to provide that contrary evidence as to why certain perceptions are misguided.

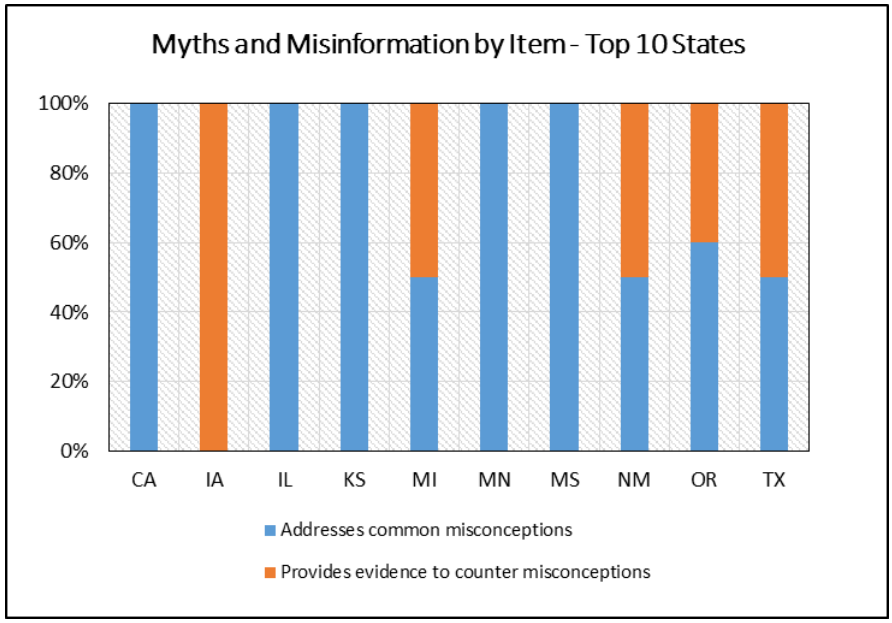


Figure 5.21 Dispelling Myths and Misinformation by Item for the Top 10 States

Text Based Resources are the Go-To Information Type for States

The type of information the resource uses to communicate the content has a major impact on the accessibility and overall understanding of the piece of information. The majority of information types in use by the 50 states as shown in figure 5.22 is text-based with 93% use on average overall. Resource collections are used an average of 47%, followed by images and still images, which are almost equal at 36 and 35 respectively. The other types of information are utilized only half as much with no use of an information service, software, or audio resource. In reporting these results it is important to note that the information types are not assigned exclusively, meaning that one resource often used more than one type.

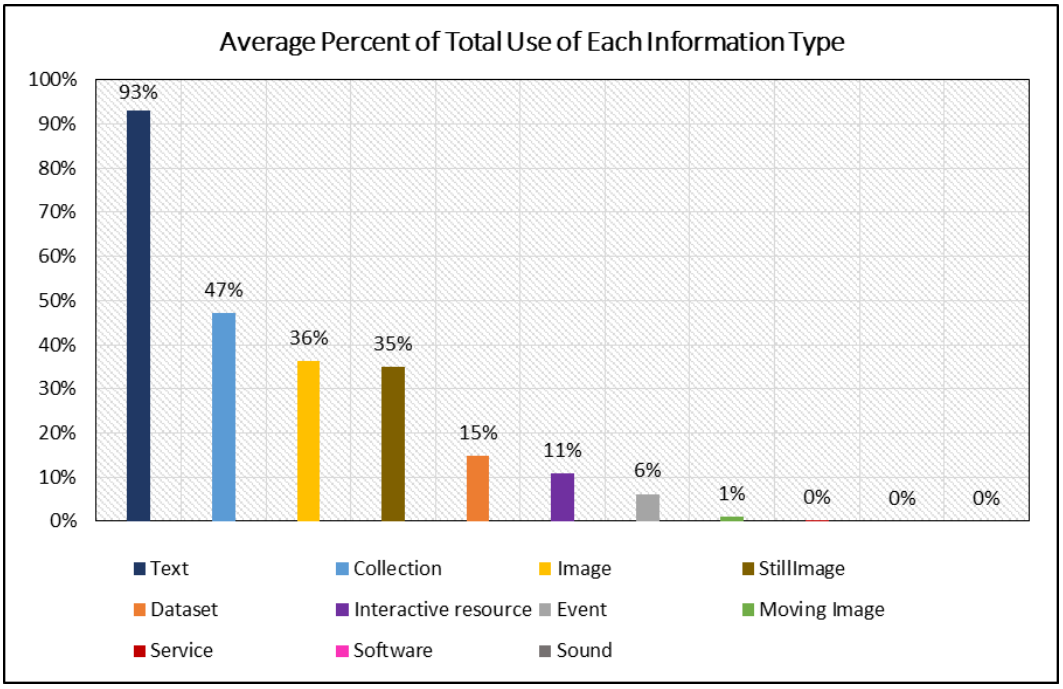


Figure 5.22 Information Type: Average Percent Use of Each Type across All 50 States

It makes sense that the majority of the information types used would need to be primarily text-based; however, in two-thirds of the resources there is no use of image types. While some of this choice of type to use may depend on the average speed of internet connection options in the surrounding region, there may also be cases where the addition of image or sound would provide better understanding and greater engagement by aligning to more diverse user needs.

There are two main differences that one can see by looking at the full breakdown of information types by state in figure 5.23. First some states have varying degrees of the different image types. Washington for example has more photographic images, while Indiana has a larger amount of still images. Second, this view allows a glimpse at the blips of color that represent a rarely used information type. Florida uses a moving image and so do Kansas, Kentucky, Ohio, Oklahoma, Tennessee and Texas. Nebraska and Oregon use a service as information type. A majority of states offer data of some kind, but nine do not. Interactivity is another component that has a small presence across the states, though some states such as Alabama, Indiana, and Ohio provide more of this type than most. This measure will be reflected in greater detail shortly. One might speculate that states with more types such as services and software are states that have more resources to use in the construction of such tools and there may be a greater perceived demand by the administrators of content. In either case, these types provide a much more specialized form of content to their users and suggest more activity within the system and the community who uses it.

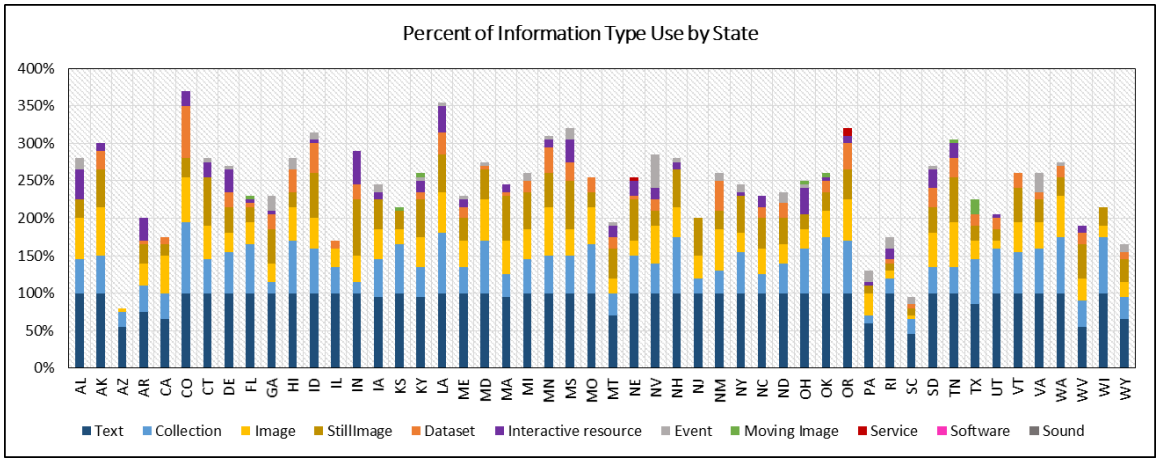


Figure 5.23 Stacked Percentage of Information Type Use by State

Information Formats: The Case of HTML versus PDF Delivery

Information formats retrieved in the results for the states are overwhelmingly dominated by two standard formats. As shown in figure 5.24 PDF and HTML format use are almost equal; both are used about 45% on average. Other formats appear in one or two resources within the whole retrieval process. Word docs are used one percent on average and RTF, PPT, PPTX, DOCX, XLS, XLSX, and ASCII at an even lower percentage.

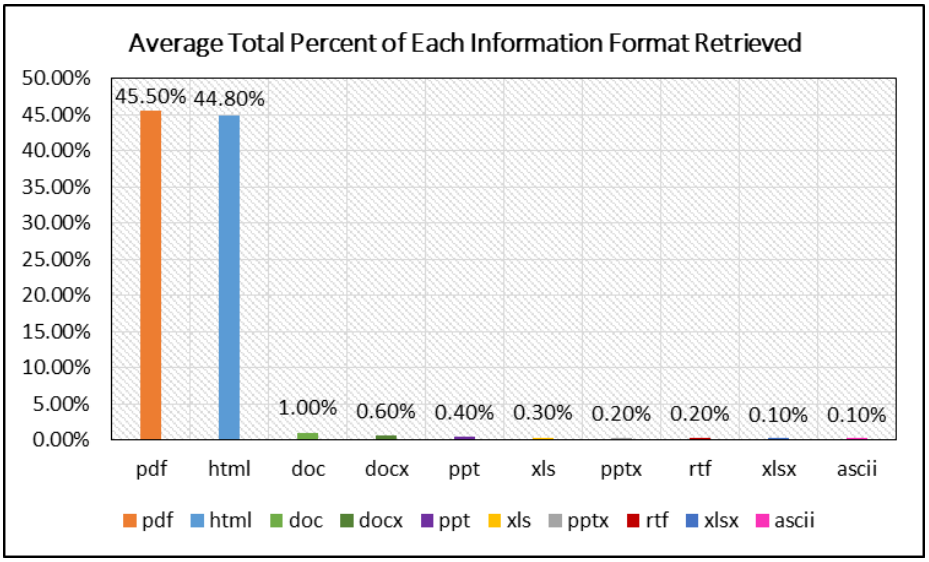


Figure 5.24 Information Format: Average Percent of Each Format Retrieved across All 50 States

This use of standard formats by the majority of the states shows an attention to delivering content that is easily accessible by the majority of users. These formats may be the most convenient ways with which to create the materials as well. One consideration for states is that certain materials cannot effectively be delivered through these formats such as when data files are transmitted. The small amounts of other

formats retrieved communicates that administrators perceive these formats to be the most effective from both the Extension and the state departments websites. More often the Extension websites are the channel where other formats are retrieved. Perhaps this is because they are a part of the larger university that the diversity of the materials becomes apparent. This may be problematic for producers who do not have access to software to deal with these files, but at the same time advantageous to have material in other formats, such as data files that would otherwise be unavailable.

Looking at percentages in figure 5.25 allows one to visualize the predominant formats used by each state as well as the instances when there are less common formats appearing within the retrieved resources. Wisconsin and Illinois only use HTML. New York, Alaska, Colorado and Mississippi use almost all PDF as their primary format. Vermont is the one state that provides an ASCII file, and Massachusetts and North Carolina are the only two using an RTF format.

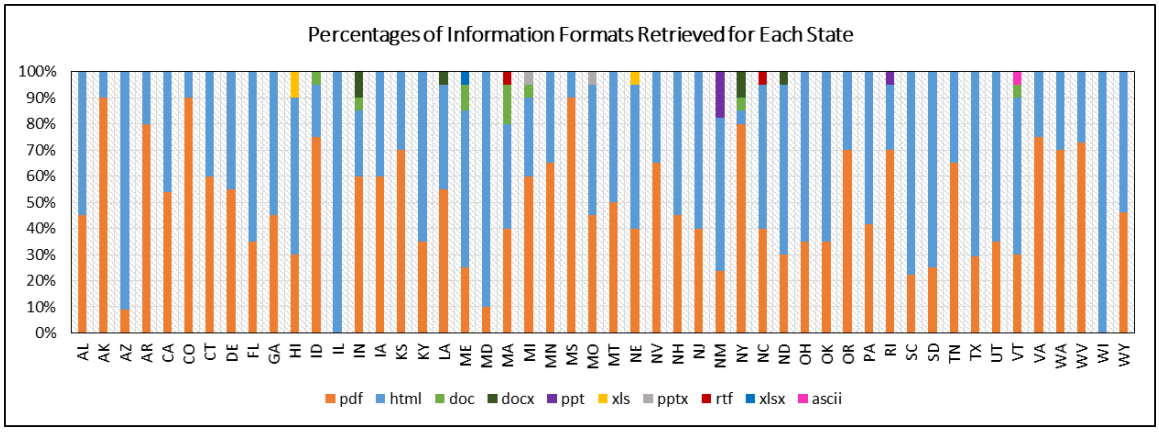


Figure 5.25 Percentages of Information Formats Used by State Out of the Total Resources Retrieved for that State

A major consideration regarding format choice by state is that certain producers and operations may be better equipped than others to handle that format. Additionally, when there is a diverse range of users, having only one format can be limiting. HTML resources fuel consideration of another issue regarding mobile compatibility in areas where many operations are connected to the internet primarily via their phones and other portable devices. In order to best provide resource access Wisconsin and Illinois must have large numbers of operations that have other available ways to connect with internet resources. Primarily mobile connected operations will experience difficulty accessing these resources unless all of the state websites are compatible with mobile devices. This is generally not the case with the websites in the analysis. One speculates that states like Alaska and Mississippi are utilizing PDF resources more often for easier access away from an internet connection. Producers could easily print out the resources to use on the job.

Information Quality Shows Little Variation between States

Measured by multiple variables of accuracy, currency, source authority, and usability and design factors, overall information quality of website content is a major requirement for accessible information. The majority of the 50 states provide a standard level of information quality. Figure 5.26 shows the total information quality average percent out of the total possible for each state. None of the states has a perfect information quality score but all have some degree of overall quality in their website

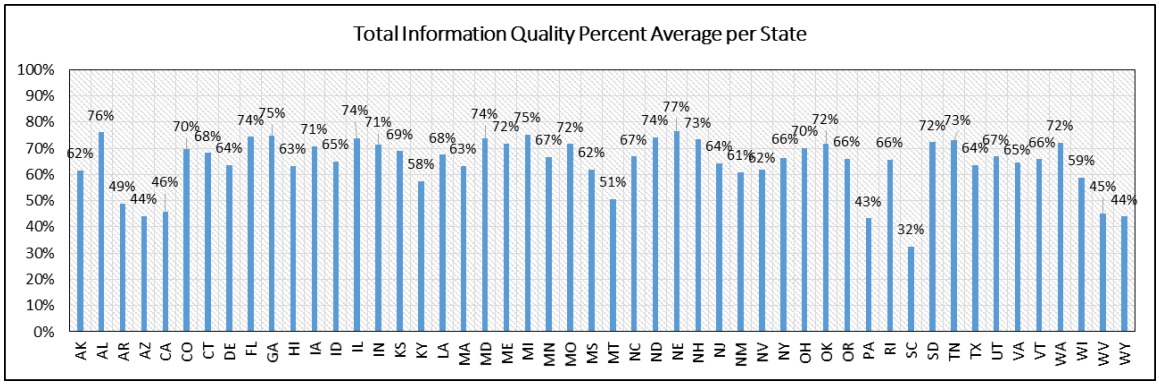


Figure 5.26 Information Quality Average Total Percent Out of All Measures for Each State

resources. Nebraska scores the highest with 77% and South Carolina scores the lowest with 32%. The majority of the states have scores over 50%.

Figure 5.27 shows the average total information quality percentage by measure. Accuracy is highest overall at 78%. Currency is the lowest overall at 48%. Source Authority and Usability and Design are similar, each with 66%. The lower level of the currency measure communicates that overall, information may not be updated very often or very quickly. Often it is not clearly indicated when the last update occurred.

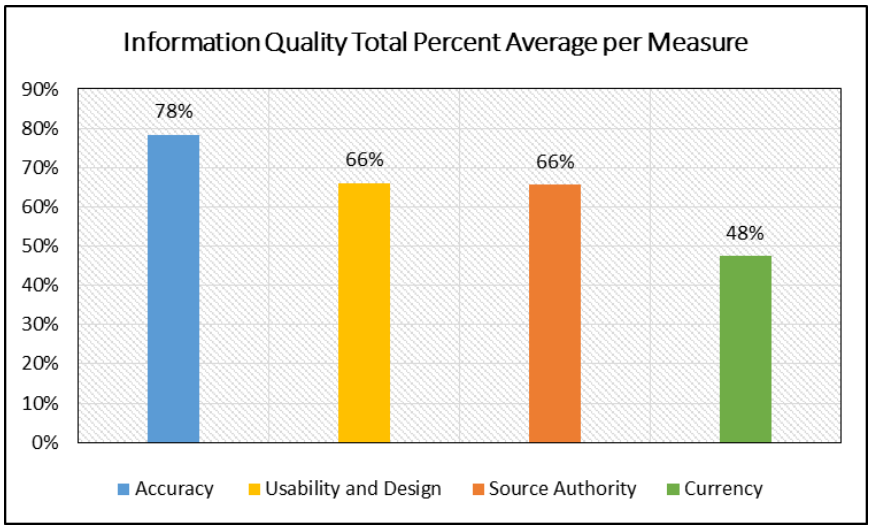


Figure 5.27 Information Quality Average Percent for Each Measure across All 50 States

This lack of currency may be problematic when there are frequent changes such as the multiple iterations in the past decade and a half which lead to the final ruling on animal disease traceability. Additionally, it may be that the items retrieved were catalogued in such a way that they come up as relevant even when the content is dated. There needs to be greater attention among content managers to organize and flush out

the old information into more of a separate archive. Unless the individual focuses on sorting by date (in the instance that the capability is even available) there are many times when less current information clutters or creates confusion in the information gained from the retrieved results.

Figure 5.28 shows the breakdown of information quality percentages by the four measures per state. It also shows the states that have less results available and as a result score lower in information quality. Arkansas, Arizona, California, South Carolina, and Pennsylvania are the states with fewer resources overall. The percent distribution of the measures is about the same for each of the states. This shows that all states have a less than or equal measure of currency compared to the other measures. Florida, Georgia, Illinois, New Hampshire, Maryland, Tennessee, and Wisconsin have larger measures of currency than most states.

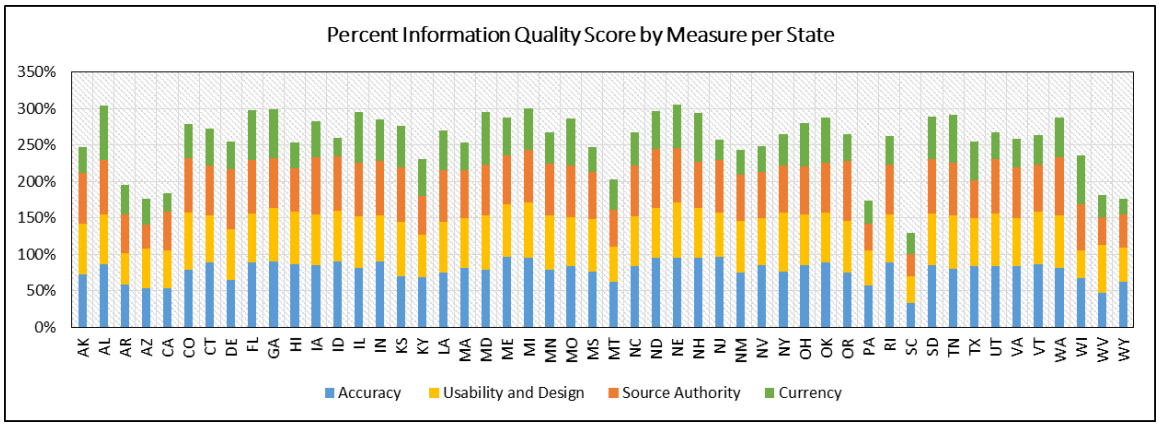


Figure 5.28 Stacked Percentages of Each Information Quality Score by Measure per State

Overall these findings indicate that the levels of quality are fairly standard and that the standards are quite high. Three out of four measures have scores above 50%. One may assume that these state resources are handled with certain attention to these elements as a matter of convention. It makes sense that there would be less extreme diversity among these resources given that they are intended to provide an authoritative voice in representing the state institutions.

Usability and Design in Greater Depth

Usability and design components carry a large degree of significance because they look specifically at the user interface and how well it works for potential users. A website can have all the information it needs, but if it is poorly designed according to the needs and aesthetic conventions of the user groups, the site and the information within remain ineffective or provide a less than positive experience. The elements in the assessment that make up this measure are adjusted constructs from usability and interface design expert Jakob Nielson (2011). Slight changes are added to his list to customize the components to the research question at hand.

Figure 5.29 breaks down the elements that make up the measure of usability and design for the top ten scoring states in this category. Certain elements have a standard amount across the ten states including: descriptive and short page titles, visible answers and main ideas, no animations and etc., text is written for online reading and supports sustainability, and a simple search field exists on the page. Other elements are more variable such as, the links works as simple hypertext reference. South Dakota scores low

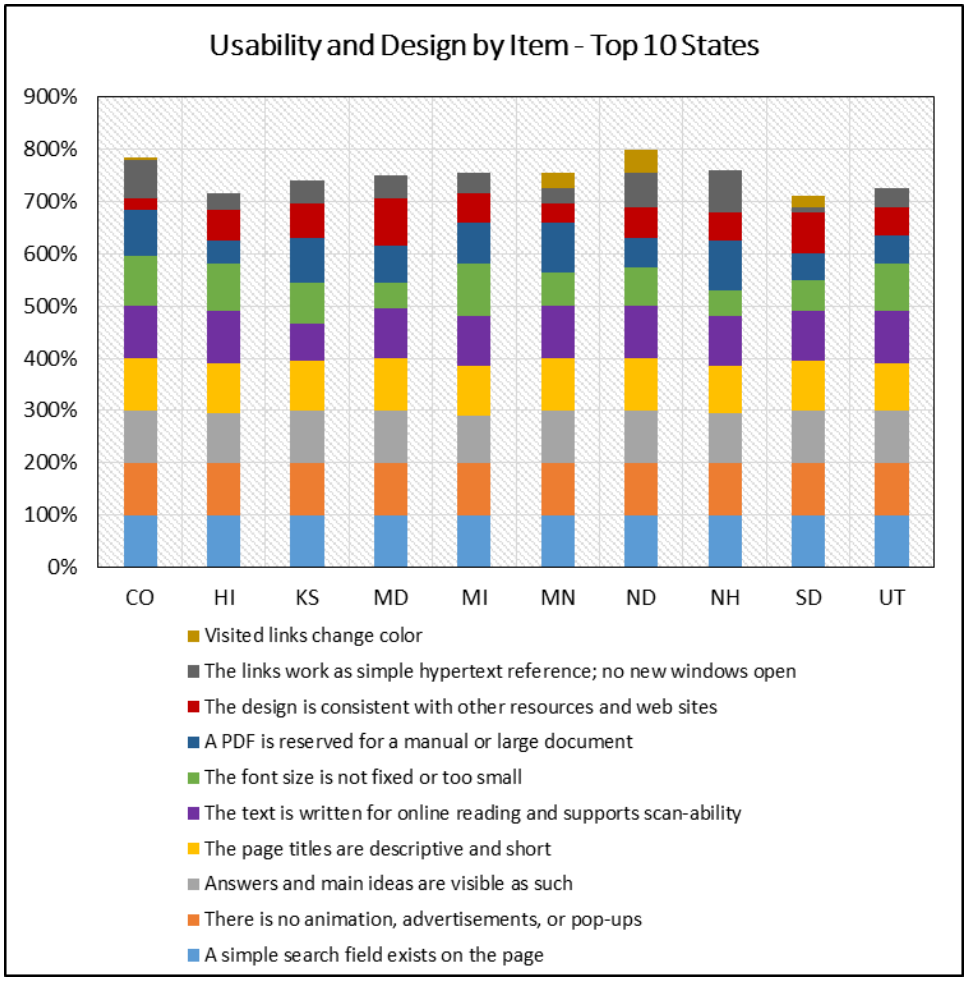


Figure 5.29 Usability And Design by Item for the Top 10 States

on this measure while New Hampshire and Colorado score much higher than most. Only three states; North Dakota, Minnesota, and South Dakota have hyperlinks that change color. Maryland, New Hampshire and South Dakota score lower in the font size is not fixed or too small. Colorado and Minnesota have smaller scores in design consistency with other resources and websites.

It is interesting to note that there are multiple usability and design factors that are standard across these ten states while others are variable. One could propose that the standard factors are most important to the functioning of the websites (such as descriptive and short page titles) and also that they communicate a sense of quality or authority (such as with no animation, advertisements, or pop-ups). Reaching beyond these wide-reaching items; however, the more variable components such as links changing color may also have a large impact on the functionality of the webpage especially in certain cases.

When there are a lot of links, one will find it hard to retrace steps and to know what hyperlinks are already accessed. One major issue is the varied attention to the font size being fixed or too small. In states where there are many users accessing information via their mobile devices, having resources with fixed properties means little to no mobile compatibility. If states such as Maryland and New Hampshire have little compatibility with mobile devices and a large amounts of mobile users, this represents a large gap in access to legible information. Legibility for those with impaired vision is also decreased when states are less attentive to specific usability factors. Web and

information resource designers will need to address some of these in order to allow users greater efficiency and effectiveness in obtaining website resources.

Interactivity Levels Vary Widely by State and Type

The interactivity level of the majority of websites for general public use are normally very high for many reasons such as the popularity of sharing on social networks. Additionally there is a potential to gain a higher degree of audience insight and engagement through the use of online polls and comment boxes. One might assume that a website with an audience seeking content devoted to agriculture and presented to those in rural areas with less advanced internet connectivity may be less likely to provide interactive components. The analysis reveals that this is not always the case. Instead the results present a much greater diversity of interactivity levels across the nation.

Figure 5.30 shows the wide range of the nation's attention to interactivity. Illinois has the highest score with 46%. The four states with the lowest scores all at nine percent include: Idaho, Montana, Oklahoma, and West Virginia. The majority of the states have a total interactivity percentage of 21 or 22%.

One may imagine that in highly interactive states such as Illinois and Wisconsin there are specific initiatives in place within the organization designed to foster interactivity through web resources. Some of the states with large amounts of cattle operations have very little interactivity such as Oklahoma and Idaho. It seems important that these states seek to do more to foster interactivity given their large population.

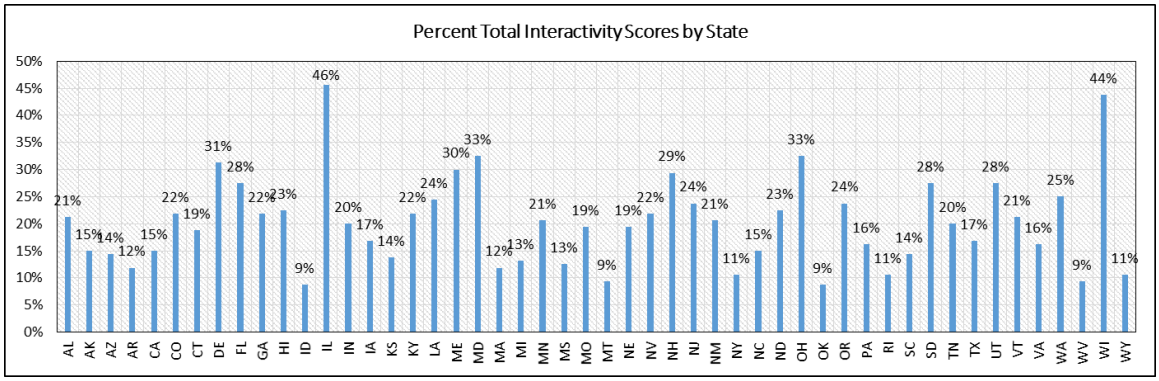


Figure 5.30 Interactivity Total Percent Out of All Measures for Each State

Interestingly this is one area of provision where Kansas scores very low. Perhaps this is the result of different cultural considerations and perceptions of the institutions about what is important?

Figure 5.31 shows the average percent of interactivity overall by each measure of interactivity. The most common element of interactivity is that the resource offers user support with 43%. Zero percent of state resources offer folksonomy or tagging capabilities to their users. Slightly above that, eight percent have advanced or customized search options. Open comment fields and requests for user input are about equal with fourteen and twelve percent respectively. Interactive media/applications for wireless devices and endorsement of a participation program are also similar with 25% and 28%. The resource offers a web 2.0 component is second highest with 32%.

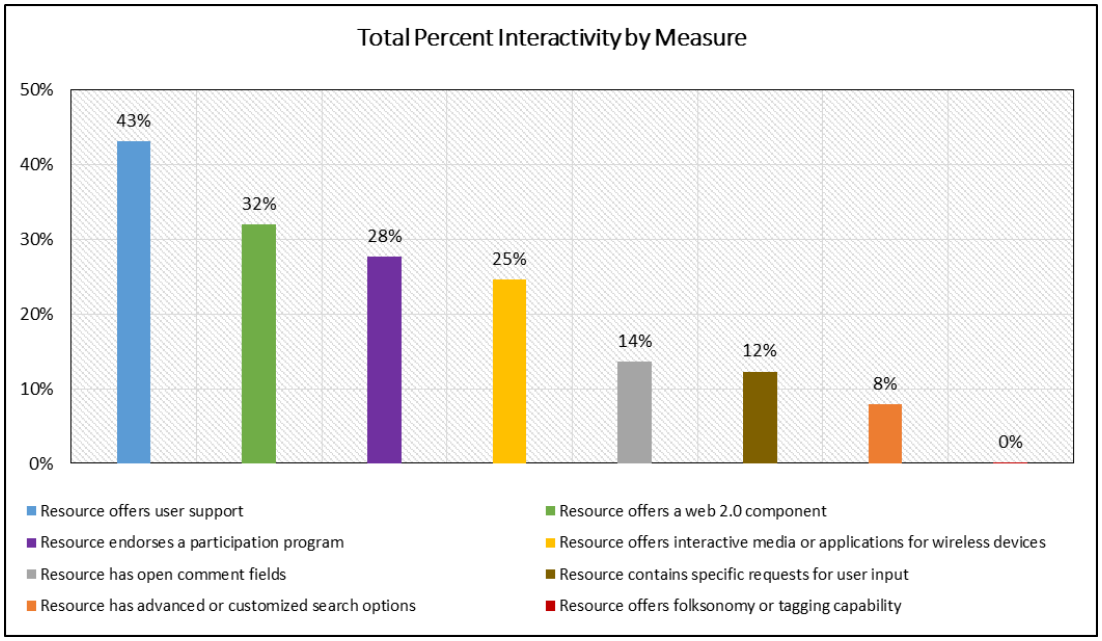


Figure 5.31 Average Percent of Interactivity per Measure across All 50 States

The small amount of requests for user input and open comment fields communicates more of a one-way, top-down flow of information from the majority of the websites. This is also seen in the way that none of the websites implement any tagging capability. This may be a way for individuals to construct shared meanings and to participate in the categorization of essential resources. (This practice seems to have gone by the wayside in many areas outside of government information too and only really seems common in social media environments.) Additionally a small amount of advanced or customized search options means that every user is getting a cookie- cutter experience even though there will always be a wide range of learning abilities and types of individuals accessing the website. There are more social media and web 2.0 components than one would originally expect. In some cases the states use multiple types of social media and/or included it as a major component on the page. In other cases nothing is available. Overall there is simply lots of variation.

The final interactivity image, figure 5.32 shows the itemized stack of the interactivity measures by state. One can see the elements that are fairly consistent across the states as well as the states that are lacking certain elements. The most apparent measure is the resource offers user support. New York, Arkansas, Mississippi, and Rhode Island have very small amounts of user support from their resources. The second element that stands out is the web 2.0 component. Only Idaho, Mississippi, and Montana are lacking this measure completely. Endorsing a participation program and specific requests for user input shown in purple and red appear with greater variability,

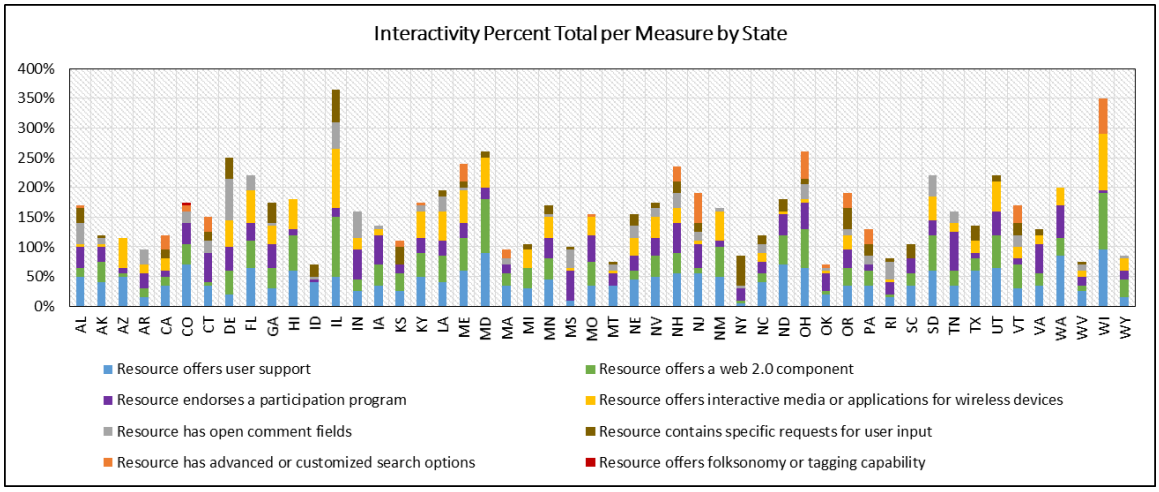


Figure 5.32 Stacked Total Percent of Interactivity per Measure for Each State

and even smaller instances are seen with the customized search options in orange and the open comment fields in grey. Colorado is unique as the one state with a folksonomy or tagging capability. This stems from their use of a Flickr account where individuals potentially tag photos. The states with the most interactive content, Wisconsin and Illinois also have larger percentages of both interactive media for wireless devices and offer a web 2.0 component in almost 100% of their resources. It is also important to note that higher interactivity correlates with higher levels of HTML as the format of choice for resources. PDFs are less applicable to (though not completely removed from) this capability.

One of the positive aspects seen in these results is the consistency of user support across the states. There are also problematic places where support is missing such as in Mississippi, New York, Arkansas. This support aspect will not be solely in beef cattle information resources; it is an issue throughout the website resources from these states. Having this type of support for the user is essential, not just in understanding issues of access that users are facing. It is also part of establishing a level of trust that there are avenues for users to connect with the administrators and that care is taken to provide that information to all users.

Relevance: An Indicator of Effective Content Management

Relevance measures are indicative of what the user retrieves through one's search engine queries. The most relevant content a website has to offer may not show up depending on the properties of the search engine algorithms. There also may be issues with the labeling and organization of the content within the website. Figure 5.33 shows the overall percent

relevance of the resources retrieved for each state. The majority of the states are above 50% relevance. Kansas has 100% relevance and Washington is second with 98%. The lowest scoring states were Montana and Texas with 40% relevance.

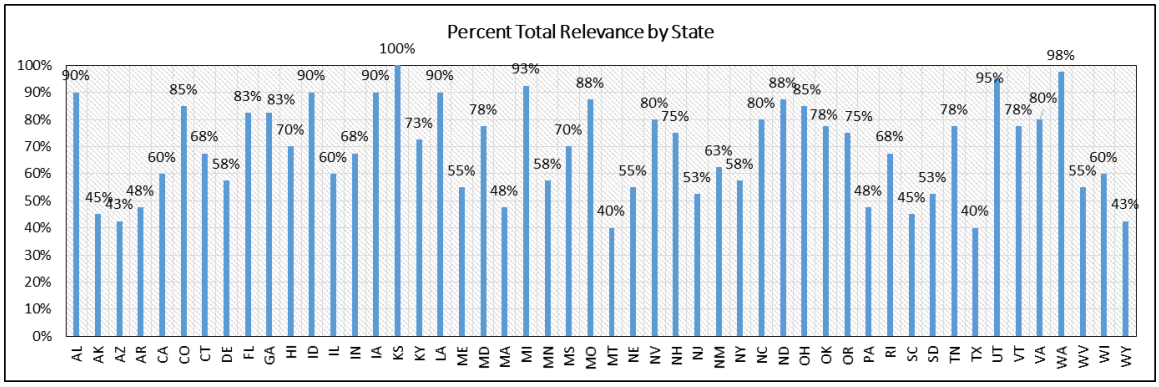


Figure 5.33 Percent Relevance of 20 Total Resources for Each State across All 50 States

Low relevance is another indication of the incongruent accessibility of information between the states. There may be relevant information available in some instances, but it may not be showing up in the results. This directly affects the overall accessibility of information for producers and other users. If it is not apparent on the main webpage, or through the search engine, the process to find this information may be difficult. Some states with the largest amounts of beef cattle operations score lowest on relevance. This means the areas who need it as much or more as states with less activity in the industry are not necessarily able to get the news and information that will help with compliance and safe guarding against dangers such as disease. The perception that an individual is left out of communications about important information potentially fosters feelings of distrust among those individuals.

Relevance Comparisons Demonstrate Strengths and Weakness among State Web Presences

The following figures 5.34 and 5.35 provide a state by state glimpse of the variations in relevancy percentages. It is important to view these two measures side by side to clearly display the differences in each website's unique ability to retrieve relevant content. In several cases states have one website that demonstrates much greater proficiency. In certain states where there is a large deficit in one presence, there may be opportunities for collaboration and sharing of resources across the state websites which might cover users of both sites with less effort to catalogue and document identical resources.

These comparisons show that states often are highly dependent on one web resource to deliver the majority of relevant content. Pennsylvania, South Carolina, West Virginia, and Wyoming demonstrate most of their relevance from Extension resources. Arizona, Texas, and Nebraska have a majority coming from the state Department of Agriculture. States with the highest overall levels are also states that have a more equal distribution of relevant resources.

Each state site may provide specific topics that are more suited to that specific organization. For example, the Department of Agriculture is potentially associated with more information about state regulations. When a state happens to rely heavily on one or other of these web presences it may mean two things. First, a section of the users are missing out on vital information as they go only to the one source that does not provide relevant information. Second, they only get a portion of the information because even

Figure 5.34 Comparing Percent Relevant between DOAG and EXT Websites for Alabama – Nevada (Alphabetical)

Figure 5.35 Comparing Percent Relevant between DOAG and EXT Websites for New Hampshire – Wyoming (Alphabetical)

though they go to both sites, the site with little relevant information is deficient in information specific to that organization and the other website fails to pick up the slack. Either way, the user will miss it. Exploration of the search engine types may reveal specific issues associated with low relevance.

The Role of the Search Engine Type

The pie chart in figure 5.36 shows the percentages of website search engines used by the websites across the nation. The majority of the websites use Google Custom Search with 46% or the engines are not disclosed. This occurs 33% of the time. The search engine types used least are Verity, and Google Translate, both at 1%. Google Search Appliance is used in eleven percent of the websites. One website has no search engine.

What does it mean when the search engine is not listed? Does one assume that this is a custom construction without a proprietary algorithm that requires one to display the brand or source? Transparency of this process is an important piece of information for users to have because by understanding the search engine users may be able to judge the retrieved information more fully.

The limited relevance scores and the high proportion of use of Google Custom Search suggests a correlation between this service and issues of poor relevancy. More exploration of this area is needed at a deeper level to connect relevancy scores to search engine types. The one website that lacks a search engine does a large disservice to producers in this state. The user will only be able to find information that is posted

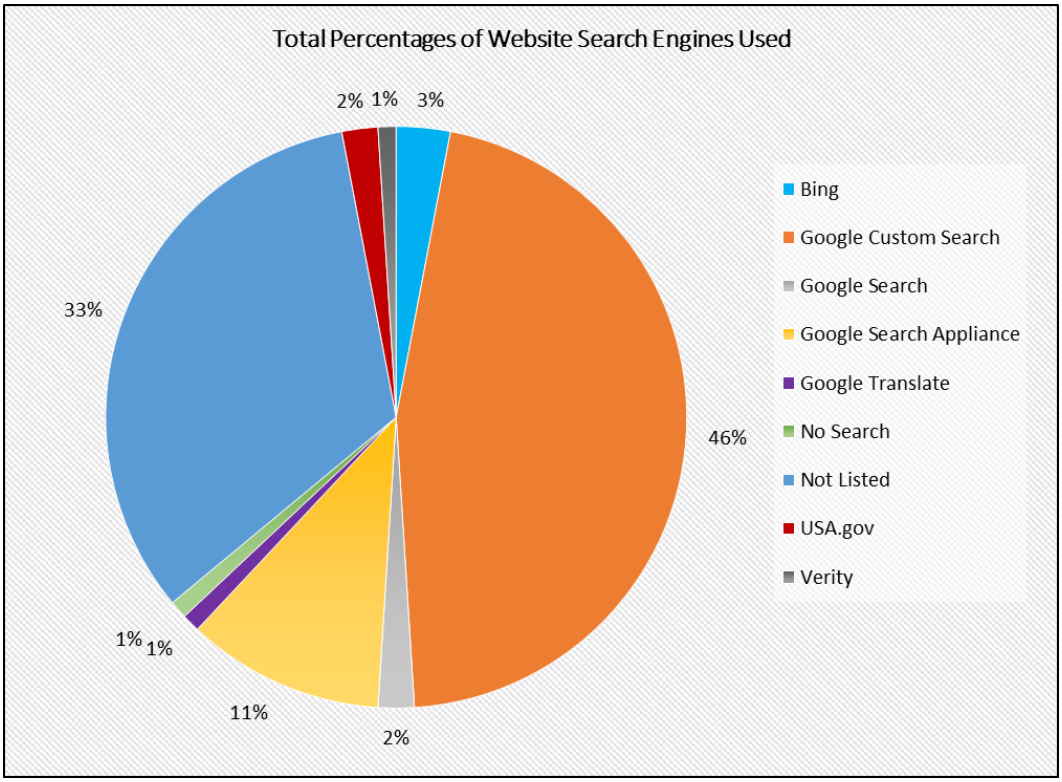


Figure 5.36 Total Percentage of Website Search Engines Used across All 50 States

from the main page menus. This will take considerably more time and there is no record of the specific resources one previously visits. The navigation process will likely be difficult to capture.

Ranking the States According to Independent Standards of Access

Taking account of all of these results together, one can see the states that perform at a higher level and those that need the most work in multiple areas. This larger comparison is an important visualization to include because it allows the state content administrators of these websites, as well as other information professionals in the state, to see where they sit compared to the other states in the nation. Potential vulnerabilities may be higher in these lower ranking states because there may be less resources getting to those who need it most.

The rank components shown in table 5.5 are calculated by taking the individual units of analysis and scoring them as a percent of the total possible score. These percentages are summed and each state receives a rank score based on the sum for this category. The state ranks for all the categories were then averaged to get an average rank score for each component. This was done for topics and information quality. Interactivity and relevance did not have multiple categorical measures so these state ranks are not an average. Instead these are the actual rank based on the total score. To read the chart one needs to look for the lower number to denote a higher level of performance in that particular area.

Table 5.5 Independent Rank Components for All 50 States[1]

State	Abbr.	Avg. Topic Coverage	Avg. Total Info. Quality	Interactivity Total	Relevance Total	Sum
Washington	WA	4.9	7.5	8	2	22.4
Utah	UT	6.4	9.5	7	3	25.9
Ohio	OH	9.8	7.75	3	7	27.55
Maryland	MD	9.5	5.25	3	10	27.75
North Dakota	ND	6.7	4.25	11	6	27.95
Florida	FL	8.1	5.75	7	8	28.85
Alabama	AL	7.3	4.75	13	5	30.05
Louisiana	LA	8.4	10	9	5	32.4
New Hampshire	NH	11.1	5.25	6	11	33.35
Colorado	CO	6.3	8.25	12	7	33.55
Kansas	KS	4.2	8.75	22	1	35.95
Georgia	GA	10.6	5.75	12	8	36.35
Wisconsin	WI	8.5	10	2	16	36.5
Iowa	IA	5.6	8.25	18	5	36.85
Illinois	IL	13.4	6.5	1	16	36.9
Missouri	MO	8.3	7.25	16	6	37.55
Oregon	OR	7	11	10	11	39
Michigan	MI	6.7	5.75	23	4	39.45
Tennessee	TN	9.6	6.75	15	10	41.35
Nevada	NV	8.4	12.75	12	9	42.15
Vermont	VT	8.4	11.5	13	10	42.9
Maine	ME	12.8	8	5	18	43.8
Delaware	DE	11.9	12	4	17	44.9
Hawaii	HI	9.6	11.5	11	13	45.1
South Dakota	SD	13.2	6.5	7	19	45.7
Virginia	VA	8.1	11.25	19	9	47.35
Indiana	IN	11.4	7.25	15	14	47.65
Minnesota	MN	6.9	9.75	14	17	47.65
North Carolina	NC	8.5	11.75	20	9	49.25
Kentucky	KY	10.3	15.25	12	12	49.55
Idaho	ID	6.3	11.25	28	5	50.55
Connecticut	CT	9.6	10	17	14	50.6
New Jersey	NJ	12.2	10	10	19	51.2
Nebraska	NE	13.8	6.75	16	18	54.55
New Mexico	NM	11	15.75	14	15	55.75
Oklahoma	OK	11.2	7	28	10	56.2
Mississippi	MS	10.6	14.25	24	13	61.85
Rhode Island	RI	11.1	11.75	26	14	62.85
California	CA	9.6	20.25	20	16	65.85
Texas	TX	13.9	11.25	18	23	66.15
New York	NY	11	12.75	26	17	66.75
Alaska	AK	12.6	14.25	20	21	67.85
Massachusetts	MA	14	11.5	25	20	70.5
Pennsylvania	PA	12.9	20.75	19	20	72.65
Arkansas	AR	13.7	17.75	25	20	76.45
Arizona	AZ	12.5	21.5	21	22	77
South Carolina	SC	12.7	23.25	21	21	77.95
West Virginia	WV	11.1	22	27	18	78.1
Montana	MT	14	18.25	27	23	82.25
Wyoming	WY	13.3	21	26	22	82.3

[1] Lower Number = Higher Rank

For the purpose of viewing and scoring the states, the researcher divides the states into five tiers according to their rank sum. According to these independent components that denote overall state performance at a general level, one can see that there is a wide variation in the delivery of these elements with a range of 60 points between the highest and the lowest. Washington ranks highest with the low score of 22.4 and Wyoming ranks lowest in the nation with the high score of 82.3. These ranks will change in the next chapter with the evaluation of the content within the context of the state characteristics. It is important to note that information types and information formats are not represented in this chart because these components of the access process are inextricably linked to the contextual and cultural needs of the user.

In this chapter the researcher discussed the direct results from the content analysis of each of the state's websites. In the following chapter 6, the analysis will delineate demographic determinants that influence the need for one type or format over another while also looking at relationships between state characteristics and specific elements of previously discussed issues of topic coverage, information quality, interactivity, and relevance. Chapter 7 will then explore the network of information resources created among the external hyperlinks provided in the retrieved results for each state. Finally in chapter 8 this exploration will yield an overview of the cumulative level of performance among the 50 states.

CHAPTER 6 – EQUITY OF ACCESS: RQ 2 RESULTS

Chapter 5 discussed the results from the content analysis portion of phase one in which the researcher took steps to answer the first research question about the information resources that are available to information seekers for each state. With a clear picture of the landscape of information topics, types, formats, and levels of information quality, along with measures of interactivity and relevance, the research now turns to the contextual significance of these measures as outlined by the second research question.

Research Question 2

In conjunction with the demographic, economic, and legislative diversity at the state level in the US, is there equity in the accessibility of beef cattle identification and traceability information for producers?

One of the first actions to take in answering this question is to define the demographic, economic, and legislative components of the producer populations in each state to see where to direct specific aspects of inquiry. The National Agricultural Statistics Survey (NASS) Census from 2012 provides these characteristics as data at the state level. The following paragraphs contain visuals that communicate the characteristics making up each state's overall profile including: the amount of operations, types of operations, economic income level, amount of operations per economic classification, Internet use, and type of Internet connectivity.

Two additional characteristics, average level of experience of the state's producers and perceived level of regulation, are measures created by the researcher to

address specific notions of access as set forth in the CIAV model. These measures are explained as they appear in the following content. They are based either on a combination of other NASS census measures as in the case of experience level or developed out of the results of the content analysis experience as in the case of the perceived level of regulation. See appendix A.4 for a list of the measures, their definitions, and the origin of each of the data sets used in the analysis.

State Levels and Types of Beef Cattle Operations

Figure 6.1 shows the total number of operations per state that have a herd of beef cattle. Texas has an amount that is large enough to be off the chart with 133, 924 operations. The next greatest amount is Missouri and Oklahoma is third. The states with the lowest totals are Alaska, Delaware, and Rhode Island. The majority of the states have slightly over or under 10,000 operations.

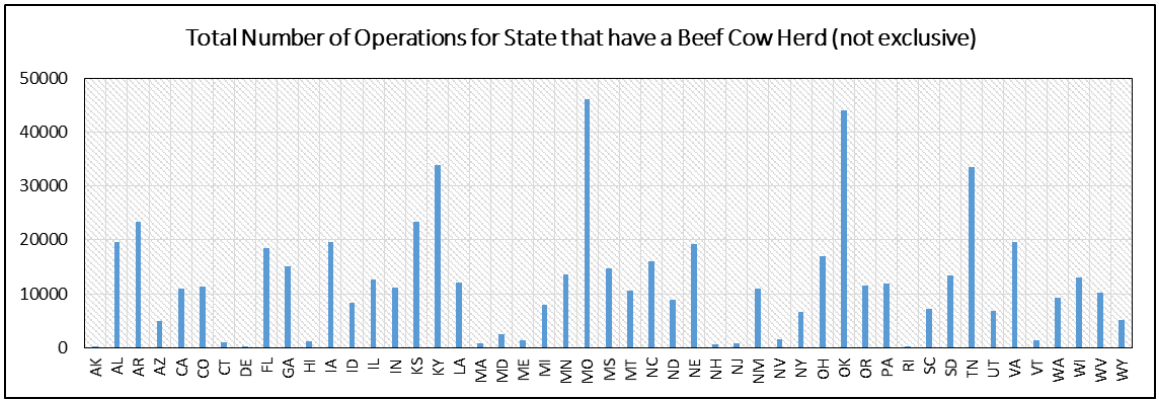


Figure 6.1 Total Number of State Operations That Have a Beef Cattle Herd for All 50 States[2]

[2] Texas has a much greater amount of operations with beef cattle (133,924). In order to accurately represent the other states it is reported separately.

The amount of operations in the state speaks volumes about the amount of individuals involved that will have an information need. The more operations there are the more risk there may be for a disease outbreak. The spread of disease and scope of devastation may also be larger in these states. There are other factors; however, besides the sheer quantity which dictate information needs. One area that is important to explore is the phases of operations or kinds of beef cattle industry that exist within the state.

Explaining the Context of Traceability in Relation to NAICS Categories

The NASS US Agricultural Census in 2012 uses the North American Industrial Classification System (NAICS) to group the economic activities across the nation for agriculture. This system is in place to provide a standard definition of activities across the US, Mexico, and Canada for the purpose of structuring effective, congruent economic analyses. This research uses two categories that define phases of the cattle industry in the US as presented in the census:

1. Beef Cattle Farming and Ranching (112111): these are establishments primarily engaged in the raising of cattle for both beef products and as replacement dairy cattle. (Primarily the cow/calf production phase.)
2. Cattle Feedlots (112112): these establishments are focused on feeding the cattle for fattening them prior to slaughter. (Primarily the Feedlot phase.)

Table 6.1 describes differences in the contextual elements that exist in the experience of individuals in the two NAICS categories. One of the most important aspects to highlight

Table 6.1 Contextual Elements of NAICS Categories

Contextual Elements	**Cattle Farming and Ranching**	**Cattle Feedlots**
Primary role in supply chain	Care during breeding, gestation, and birth to weaning: 6-9 months and approx. 400lbs	Care and feeding a mixture of forage and grain in preparation for slaughter at approx. 1000 – 1500 lbs.
Primary market	Auction market, stockyard	Food corporations: slaughterhouse, meatpacking, restaurants, grocery
Economic considerations	Very small scale, depend on the availability of forage, at the mercy of the weather conditions	Larger scale operations with greater income, more stable conditions
Access to resources/tech	Very little access due to costs, remote location and/or lack of perceived benefit	Greater access, necessary for connecting with market, often more centrally located
Role of identification and traceability	Establish ownership, genetics, vaccination and health records, tracking herd health overtime, deter theft, comply with transport regulations	Health records, quality assurance of product for consumption, tracking gains and losses for managerial considerations such as feed material choice, amount, timing.
Major concerns influencing attitude regarding federal regulation	Cost, privacy, and liability Access to income at the auction market	Access to export markets, consumer perceptions of quality and/or safety

is the role of identification and traceability in these different types of operations. The perspectives of the operators will be different as a result. All of these elements are integral to assess when thinking about the equity of accessible information available. The states may or may not be taking these elements into account with the information topic coverage, types of information, and formats of the material developed or selected for use on the website.

With this knowledge of the contextual elements of the categories one can now view the percentage of these NAICS categories out of the total amount of beef cattle operations within the state. Figures 6.2 and 6.3 show the percentage of each type of cattle operation (beef cattle farming and ranching or feedlot) out of the total number of state beef operations. Beef cattle farming and ranching is a much larger proportion of the total state operations than the feedlot operations for any state. Colorado and Tennessee are the two states where 100% of the operations are farming and ranching.

The lowest state percentages for farming and ranching are Delaware and Iowa. Iowa and Minnesota have the largest percentage of feedlot operations. The majority of the states have feedlot percentages below two percent of the total state operations. It is important to note that the two industry types will not add up to 100% in the majority of states because there are often operations with beef cattle that are not included in the industry classifications, but they may be counted in the total state operations with beef cattle. Even so this comparison provides the researcher with a better

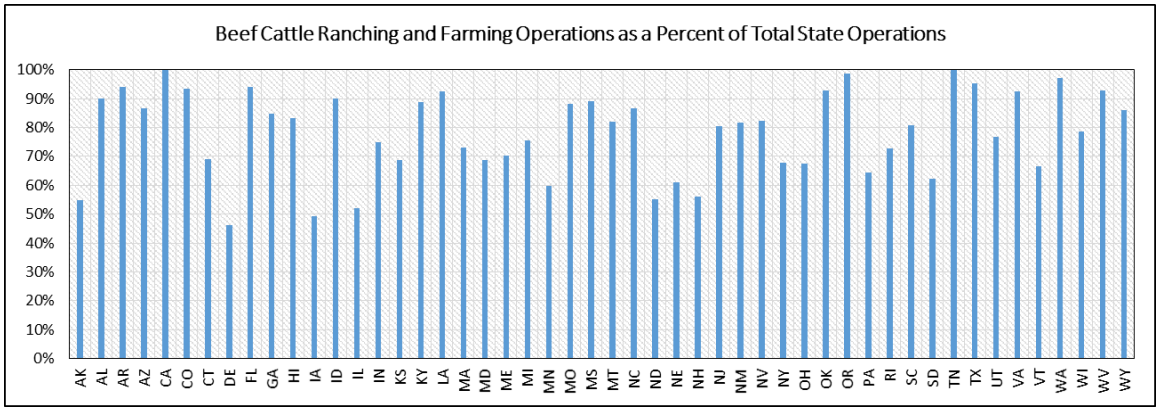


Figure 6.2 Beef Cattle Ranching and Farming Operations as a Percent of Total Operations for Each State

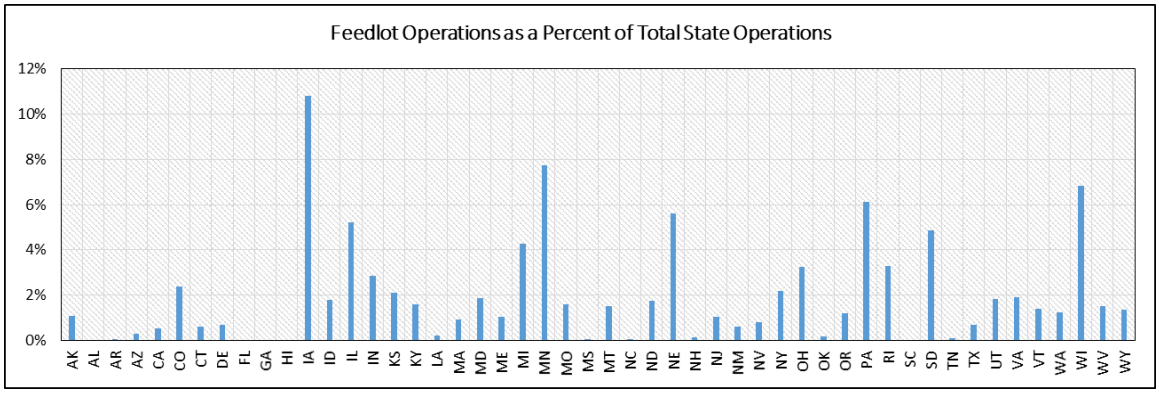


Figure 6.3 Feedlot Operations as a Percent of Total Operations for Each State[3]

[3] Note the difference in scale between figures 6.2 and 6.3.

understanding of whether that industry type should be a focus for that state's information resources.

Economic Profiles

State revenue from beef industry operations is a highly variable construct across the nation. This revenue is related to a number of factors such as the climate of the area, the type of industry phase the majority of the producers work within, as well as the scale of each of the operations within the state, to name a few. For reference of scale, table 6.2 shows the top ten and bottom ten states according to amount of total income from beef cattle. Note that the states with the top economic income do not correlate with the previously shown number of operations per state.

Table 6.2 Top and Bottom 10 States Based on their Total Economic Income from Beef Cattle

Abbr.	Top 10 Total Economic Income from Beef Cattle	Abbr.	Bottom 10 Total Economic Income from Beef Cattle
TX	13013127	VT	61905
KS	10153087	HI	37825
NE	10098166	ME	31076
IA	4504373	CT	9751
CO	4321308	MA	9503
OK	3402919	DE	9489
CA	3259325	NH	9477
SD	2968996	NJ	8829
MO	1968617	RI	1180
ID	1808929	AK	1085

In order to understand how economic income relates to the context of all agricultural production within the state, it helps to see the amount of that income from beef that is a percentage of the state's total agricultural income. There will be some

states whose income seems incredibly large or small, but the percentage places that income in context with the size and industry focus of the area. Figure 6.4 shows the percentage of state beef income to total state agricultural income. Wyoming has the highest with 65%. The lowest states are Delaware and New Jersey, each with one percent of agricultural income coming from beef. The majority of the states' percentages are relatively low at about eight percent.

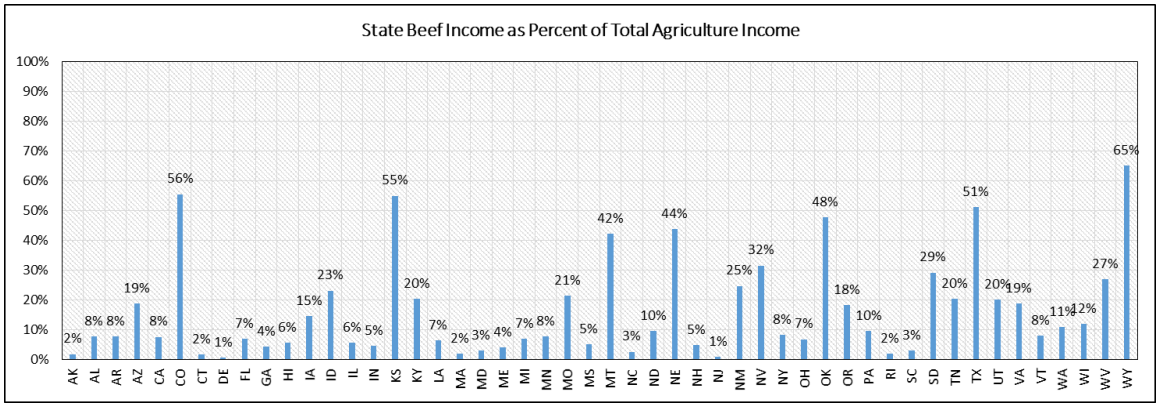


Figure 6.4 Percent of State Income from Beef Cattle Production Out of the Total State Agriculture Income

This is an effective measure for perspective about the overall importance of beef cattle production to the state. One can imagine that states with higher percentages here are more motivated to have higher amounts of materials relating to cattle identification and traceability and greater relevancy when searching for resources on the websites. States with lower percentages will be focusing on other areas of agriculture. Here there is less overall content or relevant resources devoted to the subject.

Wyoming is interesting in this case because it is not in the top ten highest states for economic income from beef cattle, but the high percentage shown in figure 6.4 suggests that there is more income coming from beef cattle than other agricultural products. In this case Wyoming is very dependent on the beef industry for agricultural economic well-being. The risk and loss associated with a disease outbreak will be most significant.

The NASS categories shown in figure 6.5 are the economic categories used on the 2012 census survey. In thinking about economic scale of states and the available information in relationship to that economic scale, it is important to reiterate how the USDA defines different scales of farming operations. Small scale family farms have an annual income lower than 250,000 dollars. Intermediate small scale family farms that are classified as low sales have an annual income less than 100,000 dollars while the intermediate sized small scale family farms that are classified as high-sales have an income ranging from 100,000 - 249,999 dollars annually. In the larger scale classifications, commercial family farms are defined as having an annual income greater than or equal to 250,000 dollars. Large scale operations range from an annual income of 250,000 to 499,999 dollars while very large scale operations have an income of 500,000 dollars or greater annually. Additionally, non-family commercial farms are also operations with an annual income equal to or greater than 250,000 dollars.

Figure 6.5 shows the economic category that the operations fall within across the nation. The majority of beef cattle farms in all 50 states are classified as small scale

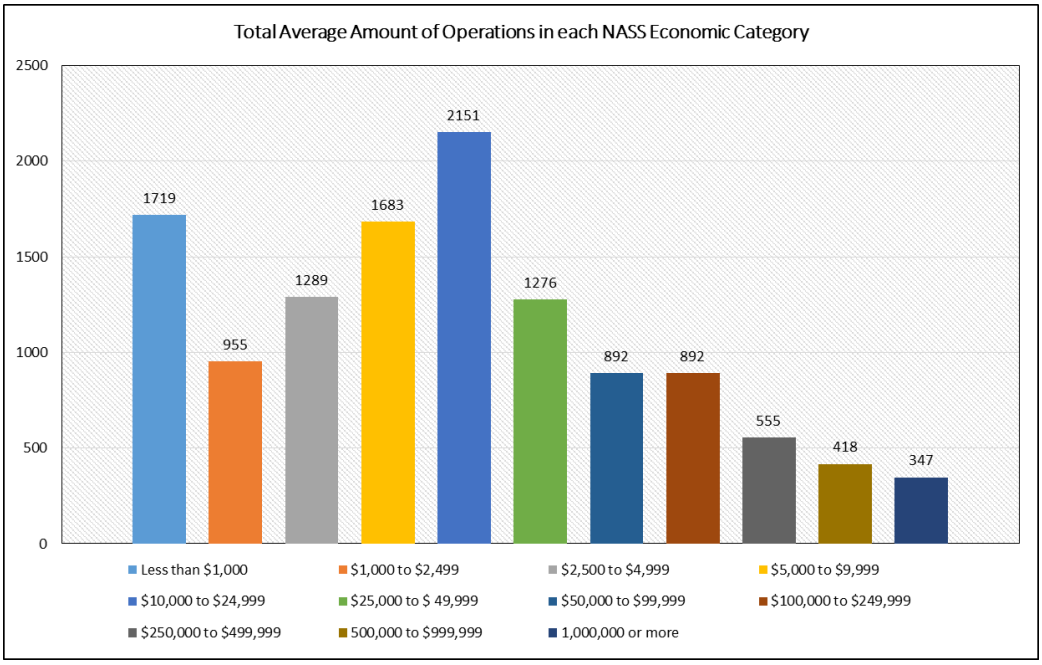


Figure 6.5 Average Amount of Total Operations in Each NASS Economic Category across All 50 States[4]

[4] Due to extreme size difference Texas was omitted from these averages

operations. The greatest amount fall in the 10,000 to 24,999 dollar annual income range and the second greatest amount fall in the smallest category with less than 1000 dollars as their annual economic income. The fact that the majority of the operations overall are below the cut-off between large and small-scale operations means that the majority of the information overall should be geared more toward the perspectives of these small scale operations.

Multi-faceted views such as the one shown in figure 6.6 are an integral part of the visualization of the components that make up the economic profile of each state. When looking at a detailed spectrum of economic categories (as in figure 6.5) broken down state by state it is difficult to fit all the information effectively into a format so that one can compare the states together. This is where spark lines are helpful. Spark lines are a tool offered in Microsoft Excel to simply display a row of data for quick visual comparisons. When the rows are viewed together, each bar in each small visual represents a column in the table. In this way, the researcher can provide a state by state view of the NASS economic categories displayed in figure 6.5 at the state level.

When viewing the figure, each bar in each mini-graph represents the same categories starting with the lowest economic income bracket on the left and ending with the highest economic income bracket on the right. To understand the comparisons, pay attention to the shape of each mini-graph in comparison to figure 6.5. Some states will have bars of greater length on the left, which shows that they have a larger population of lower income level operations versus the states that have bars of greater

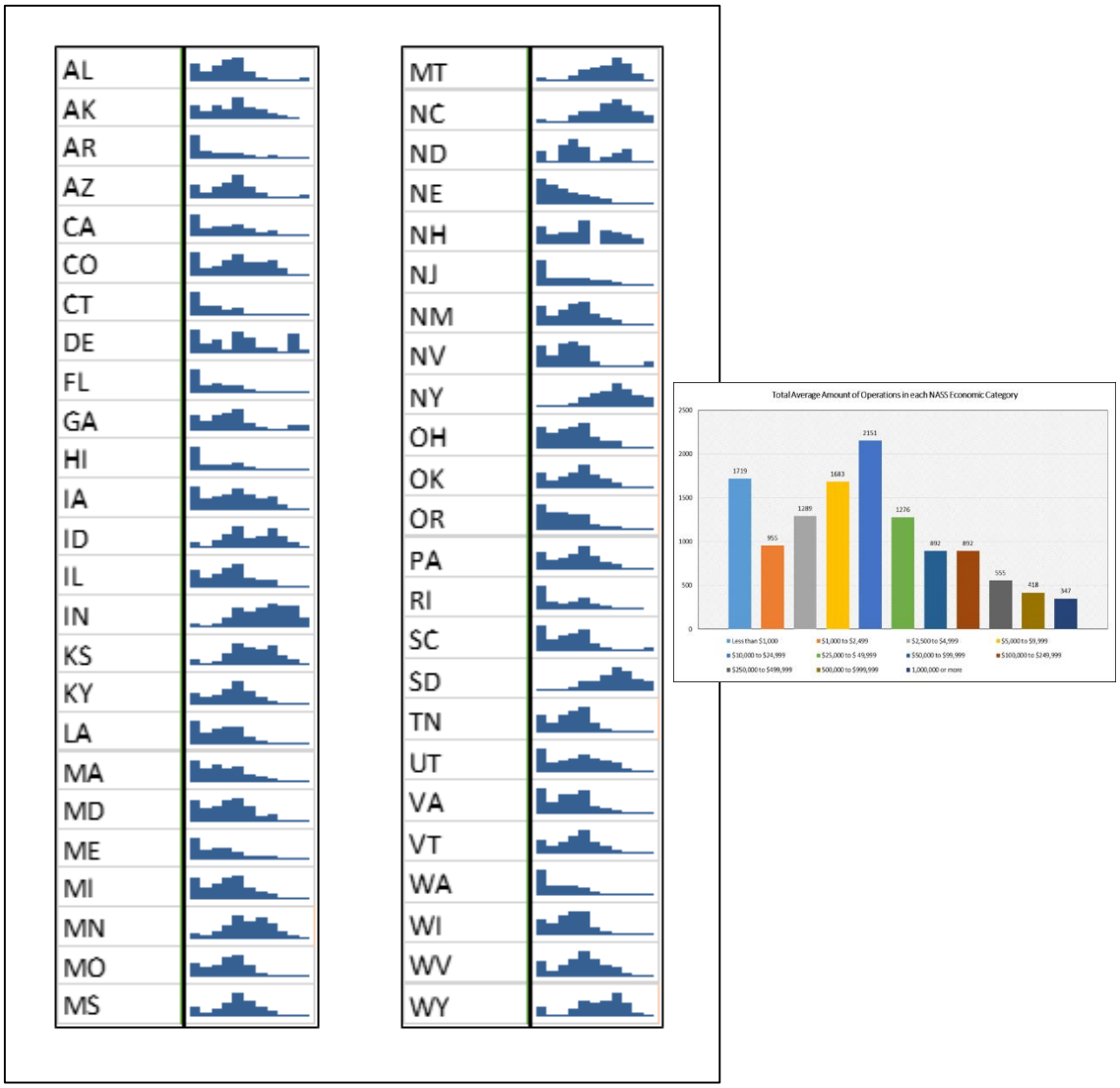


Figure 6.6 Spark Lines Showing the Breakdown of Economic Income Levels per State

length on the right. This signifies a larger population of higher income level operations. A majority of the states echo the almost natural curve shown in the total average with the slightly taller left side that indicates an increase in the number of operations that are very small. One can also see the states that are very different such as Illinois or Delaware which have less in the center and more in the small and larger economic categories.

Aspects of State Internet Access

Access to the Internet is a major factor for a contextual understanding of the information needs and levels of accessibility within a specific state. States with a larger population of connected operations will naturally have a larger need for access to content online; however, as the nation does become ever more equipped with the infrastructure to handle connections in rural areas, states need to be prepared to handle this increased demand. As younger producers move into an area of production now dominated by experienced individuals in their fifties and sixties, more information seekers may turn to online channels for information and support in their daily activities.

Figure 6.7 shows that the current state with the highest percentage of beef operations connected to the Internet is California with 80%, followed by Oregon with 78%, and Washington with 75%. The lowest is Delaware with 25% and Arizona is second with 34%. The majority of the states have slightly under 50% of Internet connected beef operations. With this in mind one expects the content levels of these highly connected states to be much higher than average while states such as Delaware and

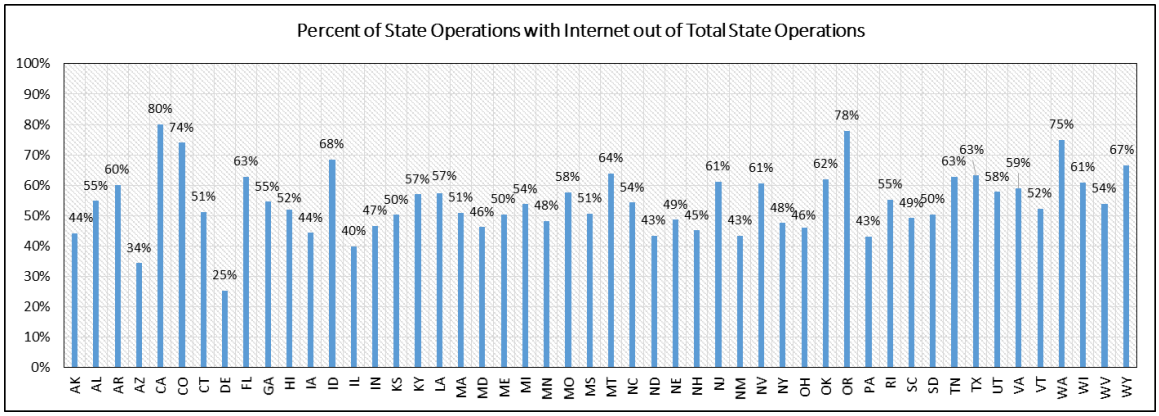


Figure 6.7 Percent of State Beef Cattle Operations with Internet Connections Out of the Total State Beef Cattle Operations

Arizona will naturally be less focused on web-based information. States with less Internet connected operations will be at a greater disadvantage overall when it comes to communicating quickly in the event of an outbreak. Producers will need to travel distances to reach a facility such as a public library or Extension office in the event that they need to use online resources. This will also factor into the context of the evaluation.

The Prevalence of DSL as the Main Mode for Internet Access

Choices for the method of access for Internet connected producers within a state may be dictated by the types of connection channels available in the area. Network speeds and interference in specific instances will dictate the quality of the access to the available resources. Table 6.3 lists and defines the types of Internet access as categorized in the 2012 agriculture census.

Table 6.3 Definition and Speed Levels of Internet Access Types Used in the 2012 Ag Census

Access Type	Defining characteristics	Speed
Broadband over power lines	Relatively high-speed digital transmission over public electric power lines.	500 KBPS - 3 MBPS
Satellite Service	Provided through geostationary satellites that offer high speeds, issues of interference with weather.	Up to 50 MBPS
Cable Modem Service	Uses TV channel space for data transmission	512 KBPS – 20 MBPS
Dial-up Service	Analogue, slow, through telephone service, converts signal to digital	2400 BPS – 56 KBPS
DSL Service	Digital Subscriber Line, always on, connection delivered through telephone service.	128 KBPS – 9 MBPS
Fiber-optic Service	Uses bundles of fiber-optic cables larger amounts of data longer distances - higher cost	100-1000 MBPS
Mobile Broadband Plan for a Computer or Phone	3g /4g network - special considerations for compatibility with screen size and data limits	5 MBPS – 12 MBPS

Figure 6.8 looks at the average Internet access type across all 50 states. The graph shows that DSL service is the most common. Broadband over the power lines is the least common. The other less commonly used type is fiber-optic service. This is potentially due to the higher cost of this type of service. Note that the "other" category is actually reported more often than broadband over the power lines.

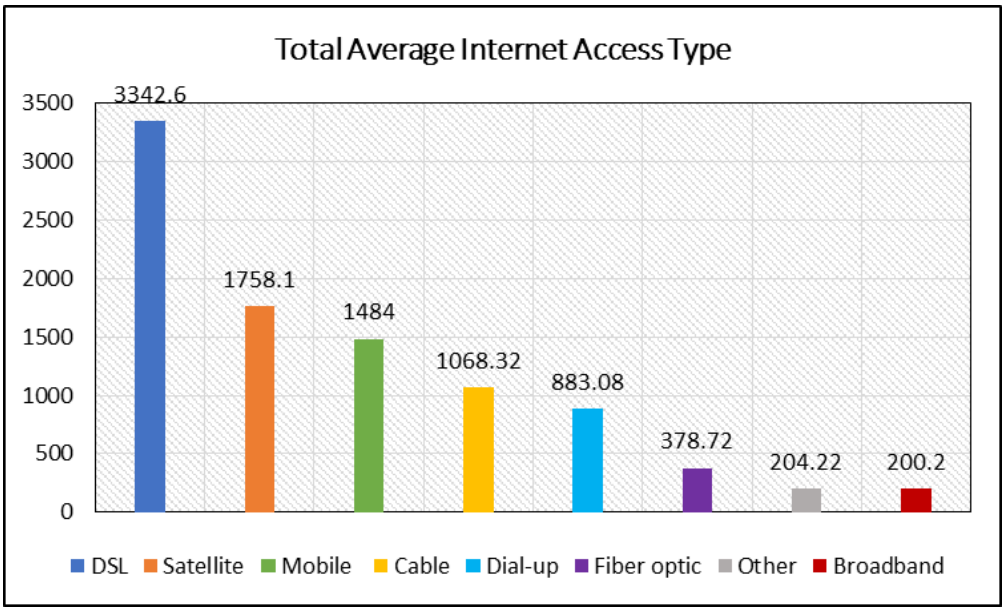


Figure 6.8 Average Total Internet Access for Each Type across All 50 States[5]

In past years there was a big push in the US and internationally to get areas that are currently in need of Internet access connected through broadband over the power lines. The project in the US looked to bring services to almost 340,000 people in rural

[5] NASS census documentation does not specify what would be or was reported for "other."

areas of Southern, Eastern, and Midwestern states such as Alabama, Pennsylvania, and Wisconsin to name a few. This initiative was never fully realized. After global testing by electric companies in a multitude of contexts, the firms found that with increasing volume, the high amount of interference and lowered speed of delivery made the services an unviable option. Another problem arose from the inability to define specific international standards because of the many heterogeneous aspects of the services overall (Martin, 2013, October 15).

The minimal attention to this type of access is reflected in the low scores for broadband over the power lines compared to the other types. The prevalence of DSL means that a majority of the producers with a connection have a moderate speed of access. Thus the ability to use certain media and download large documents or image files is at an average amount as compared with higher speeds of fiber-optic, cable, and satellite service. The speeds for DSL are comparable to mobile network access while mobile has special considerations for compatibility regarding screen size and data plan limitations. Specific state amounts of use for each type dictate considerations for determining the accessibility of website content.

Figure 6.9 shows this distribution of Internet access types for all 50 states. This view is important because it helps one compare the unique aspects of Internet access to producers and website users in a specific state with the other states. DSL is the most consistent in amount across the states. Delaware and Rhode Island are the two states with minimal use of DSL compared to other types. Every state has some satellite and

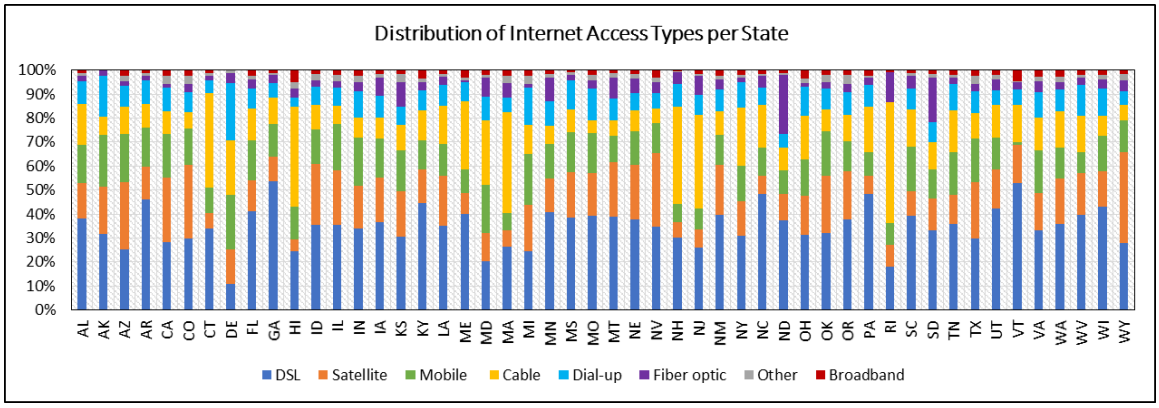


Figure 6.9 Distribution of Internet Access Types per State

cable users, but the percentages fluctuate heavily. Wyoming and Nevada have especially large amounts of satellite service use and Rhode Island, Connecticut, Hawaii, New Hampshire, and New Jersey have large amounts of cable use. Rhode Island is the only state that does not have any operations using dial-up, while Delaware has the largest amount of operations that use this type of access. All states have a small amount of fiber optic users, except in North Dakota and South Dakota, which have a larger portion. Every state also has some mobile users. The smallest mobile use is in Vermont and the largest is in Delaware. A few states do not have any broadband over the power lines users. These include: Alaska, Delaware, and New Hampshire. Alaska, New Hampshire, New Jersey, Rhode Island, Georgia, and Vermont report no “other” types of access.

Looking at the patterns of access across the states it seems like the two access types, cable and satellite, are regionally preferred and/or chosen with satellite being more prevalent in the West and cable being more common in the North East/New England region. There are not many states that have an equal number of both cable and satellite. Those areas with greater dial-up use such as Delaware and Alaska may have more issues getting materials from websites that are image intensive, have a large file size, and/or include video or audio. Areas such as Kansas, North Dakota, and South Dakota with a larger proportion of fiber optic users have more opportunity to capitalize on high connection speeds in the type of material they offer from their websites.

It is surprising that mobile access is not greater overall. This has changed some in the recent years since the 2012 agricultural census. A 2015 Pew Research report

noted that approximately two-thirds of all Americans own a smartphone and this has increased from 2011's report of 35% (Pew Research Center 2015). Additionally, one expects that the places where mobile use is extra low may be areas with less ability to connect to cellular networks. This could be the case in Vermont.

Defining a State Experience Score as a Component of Information Equity

The state experience score is a measure that the researcher created from NASS 2012 census data sets in order to define a level of experience as a cattle producer. This is important because if the producers in an area are younger and/or less experienced in dealing with cattle identification and traceability practices and issues, this state will have a greater need to provide basic information and instructions. There will also be differences in the way that these producers use technology and differences in their perspectives on the rationale behind implementing regulations and guidelines for identification and traceability. The average years the primary operator has worked on a farm provides the level of experience in the industry and defines specific expertise while the average age of the primary operator tells more about the life experience and generational context that will influence use of technology and perspectives to a greater extent. Adding these two measures for the state together yields a combined experience score. Higher experiences overall are reflected by higher numbers and vice versa.

Figure 6.10 shows the results of the calculated experience scores for all 50 states. The state experience scores are very similar overall with the highest being Vermont and the lowest being Delaware. The differences between these experience

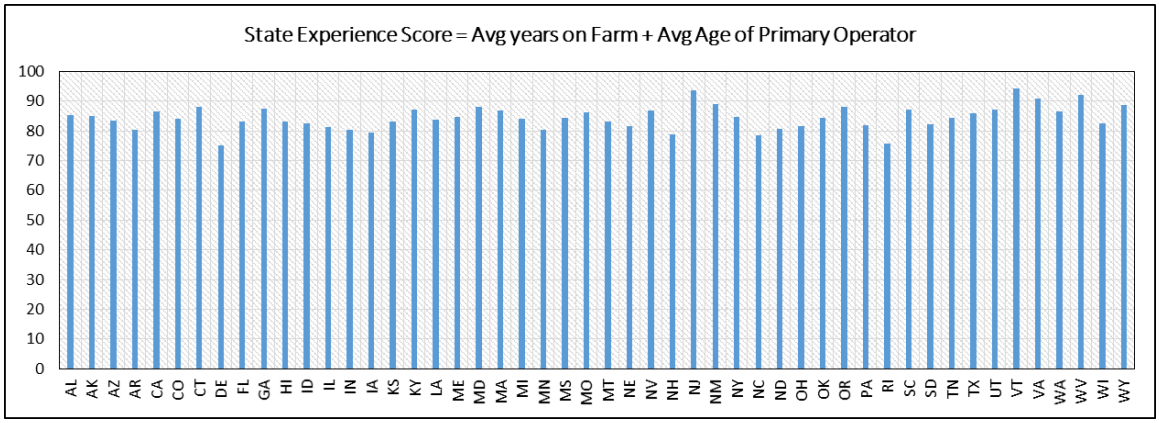


Figure 6.10 Calculated State Experience Scores for All 50 States

scores is so minimal it is hard to gain much perspective, or put much weight on the information needs of any specific state. The researcher suggests this will change in the future as more individuals in younger generations take up farming in certain areas. For example, places like Colorado and Oregon are seeing greater amounts of young people involved in slow and local food movements, supporting agricultural endeavors, and establishing themselves as producers as well. This is not reflected in the experience score; however, if the trend of youth engagement in agriculture continues will mean a major shift in this demographic category and change some of the characteristics of information needs. This measure is meant to assess and support these changes as they occur.

Perceived Degree of State Regulation: Defining a Scale

The researcher also created this measure as a construct to assess communication regarding state regulation. This measure is a subjective assessment that the researcher coded after looking at all the information retrieved from the two state websites. The researcher bases this measure on the communicated aspects of regulation in those retrieved resources giving a numerical score of one through five to address a spectrum of legislative control. A level five is the highest amount of perceived regulation and a one is the lowest with no discussion of regulations, explicit guidelines, or incentives to adopt identification or traceability practices. Table 6.4 provides a description of the scale categories. This is an important element to assess when it comes to equity of information because the communication about the regulatory practices may

Table 6.4 Description of Scale Categories for Perceived Degree of Regulation

Scale	Description of Category
1	No visible discussion of regulations and no explicit guidelines or incentives
2	No visible discussion of regulations, but gives guidelines about process of identification
3	Discussion of regulations, there could be voluntary programs but without explicit incentives or guidelines available
4	Discussion of regulations, Voluntary traceability system with discussion of incentives and/or guidelines
5	All cattle premises must be registered within a state system

or may not be congruent with the actual level of legislation. It will also influence the information needs and behaviors of the users in that state.

Figure 6.11 shows the score for perceived degree of state regulation for all of the states. The majority of states score in the middle of the spectrum with a three. Michigan and Washington rank highest with a score of five. Arkansas and Delaware rank lowest with a score of one.

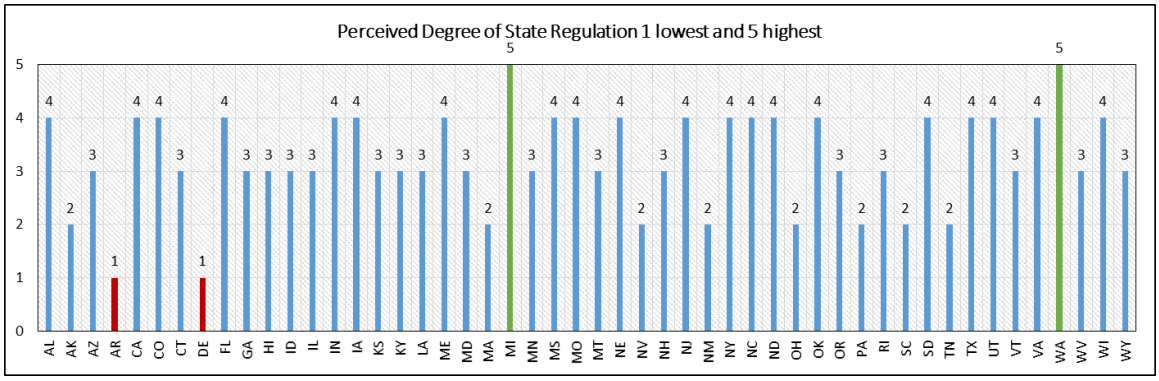


Figure 6.11 Scores for Perceived Degree of State Regulation for All 50 States

The lowest ranking results are expected given that Delaware has a very small amount of producers and both states have a low percent of income from beef out of the state's total agricultural income. The two highest states are also states that have had specific difficulty in the recent past with foreign animal disease. The problem is that many of the states with a larger amount of operations and a higher income from beef are not necessarily the ones that have the higher perceived degree of regulation. This is especially important to note for states bordering other countries or states that have high feedlot operation populations where cattle are often coming into the state from

other areas. The regulations are fairly standard now that the Animal Disease Traceability ruling is in place; however, the degree to which this is discussed as a state regulation in compliance with the law, or a federally imposed rule that producers will need to follow, changes the perception of the nature of the regulation entirely.

Accessibility of Website Content in Context

Basic Information Needs That All Websites Should Provide Their Users

Based on the current understanding of the landscape of content available to users about cattle identification and traceability the researcher constructed a list of standard things that all states should have on their websites in order to maintain a minimum level of accessibility and attention to providing the producers of the state with information related to security of the state's beef cattle operations.

- All states should have information regarding guidelines and regulations.
    - *Yes, Michigan has the most with 45%, but Montana has only one percent and South Dakota is also low with three percent of resources addressing this topic.*
- All states should have some relevant resources.
    - *Yes, Kansas has the most with 100% and Montana and Texas have the least with 40%.*
- All states should address the risk of foreign animal disease and biosecurity in some way.

- *Yes, Colorado has the most with 43% and Montana has the least with two percent.*

- All states should provide more than one information format from the website.
    - *No, Wisconsin only has one. Both websites only returned HTML resources*.
- All states should have some accurate and current information.
    - *Yes, Alabama has the most current, Maine and Michigan the most accurate. Idaho has very little current information and South Carolina has very little accurate information*.
- All states should have a search field or search box to look for specific information.
    - *Yes, all states have a search field. Only West Virginia's Department of Agriculture lacks a search field. (Though their Extension website does.)*
- All states should have contact information available.
    - *Yes, at least one of the two websites for each state have contact information available.*

Six out of seven items pertaining to basic information needs got an answer of yes; however, there are still more elements to consider that will facilitate better information access and communication. There are certain states such as Montana and South Carolina which need more attention in multiple categories to these basic

elements of information need. This list is also available in the Appendix (A.6) as a checklist for use in future analyses.

Statements of Need Based on Identified Contextual Factors

Now that the demographic contextual factors for the states are identified, the next step is to establish statements or hypothesis of needs that should be addressed given those factors. Each demographic area addressed in the previous section is listed as a category and within each category the researcher lays out one or more statements that address the content analysis areas reported in chapter 5. These statements are examples of the types of statements that web administrators can use to assess their level of congruent attention to their state's context. Administrators and other analysts in a specific area will find statements to add to these lists that further delineate the best possible information scenarios for their state. The list is as follows:

- Amount of state beef operations total
    1. States with a larger amount of beef cattle operations should have greater overall topic coverage.
    2. States with a larger amount of beef cattle operations should have more relevant resources.
    3. States with larger amount of beef cattle operations should have more information topic coverage about prevention of disease outbreaks.
- Operation types: cattle farming and ranching operations vs. feedlot operations

1. States with greater cattle farming and ranching operations should have more coverage of basic information and overviews of the concept.
2. States with greater feedlot operations should have more information topics dealing with market benefits and risks as well as types of technology.
3. States with greater cattle farming and ranching operations should have more information with images and resource collections to supplement text heavy sources in the interest of time and readability and to aggregate more outlets that more rural producers might otherwise not know about.
4. States with greater feedlot operations should utilize more types of information such as software and datasets.

• Economic Profile: total beef cattle income as a percent of total state agricultural income

1. States with greater beef cattle income as a percent of the total state income should have greater overall topic coverage.
2. States with greater beef cattle income as a percent of the total state agricultural income should have more relevant resources.

• Economic Profile: small scale vs. large scale producers in state

1. States with more small scale operations should have more information topics addressing cost, liability, and privacy. (These are the top three concerns for small scale producers cited in the literature.)
2. States with more small scale operations should also have more information addressing myths and misinformation. (The literature speaks about the informal networks of communication among small scale and rural agricultural producers)
3. States with larger scale operations should have more information topics dealing with market benefits, market risks, and national biosecurity measures.
4. States with smaller scale operations should have more standard information formats such as HTML, PDF, RTF, and TXT because producers may not have access to software that will read other formats such as PowerPoint or Excel.
5. States with more small scale operations should have more information topic coverage on issues of personal financial gain related to implementation.

• Internet access: Amount of beef operations with Internet access as a percent of all beef operations in the state

1. States with a smaller percent of Internet connected operations out of their total operations should utilize PDF information formats more often

to allow easier downloading and printing at a library or other resource center.

2. States with a larger percent of Internet connected beef cattle operations should have greater overall topic coverage and interactivity.

- Internet Access: type of service most commonly used or available
    1. States with high numbers of mobile users should have websites that are compatible with mobile devices. This corresponds to the Usability and Design item: “The font size is not fixed or too small.”
    2. States with high numbers of mobile users should have greater interactivity scores – in particular “offers interactive media or applications for wireless devices.”
    3. States with high numbers of dial-up Internet users should have fewer images and especially moving images used as information types.
- Experience Score
    1. States with a lower experience score should have more content covering topics of How-tos and Instructions as well as Basic Information.
    2. States with a lower experience score should have more images and resource collections as information types to provide more complex and visual understanding of the issues.
- Perceived Degree of State Regulation

1. States with a higher perceived degree of state regulation should also have a higher level of attention to the information topic of Guidelines and Regulations.
2. States with a higher perceived degree of state regulation should also be states with a larger amount of total beef cattle operations and a larger percent of income from beef cattle.
3. States with a higher perceived degree of state regulation should also be states with a high score in information quality, especially in currency.

Introducing the "Tier" System for Evaluating Relationships

The following steps describe the process that the researcher took in order to visually explore the nuances in accessibility for the multiple hypotheses that are stated in the list above.

1. For each of the measures in question, the states are ordered by their scores for that measure either from greatest to least or least to greatest depending on the statement.
2. The researcher finds the median score for each of the measures.
3. Each measure's state scores are divided into tiers based on a combination of the median and the intervals between scores so that there are three tiers. The dividing rule between tiers is that there needs to be a split of at least 0.5 of a point between tier intervals. The middle level is represented with the yellow cells, the top tier is represented in green, and the bottom tier is

represented in red. The top tier is displayed in the table for the initial independent variable in the statement and the dependent variable measures for those states are compared with the top tier states for the independent variable. Figure 6.12 shows the color/tier relationship.

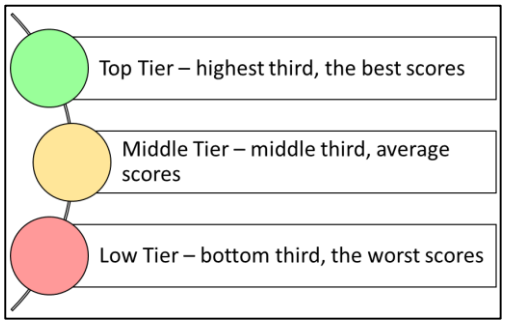


Figure 6.12 Color/Tier Relationship

4. At a quick glance one can see whether the states are delivering what the statement suggests, or whether they fall short.
    - A green cell means the state is aligned with the statement, has a high level of performance, and a top tier ranking.
    - A yellow cell means that the state is average, with a middle tier rating, and that the state has partial alignment with the statement.
    - A red cell means that the state is in the lowest tier and has a below average alignment with the statement.
5. To accumulate scores for the starred ranking system, the researcher gives a point to each state that has a green cell for that statement and adds these up across all the comparisons.

6. The total scores are then ranked with the top scores being number 1 and increasing with the lower scores.
7. The rank amount is then added to the original independent rank component average from chapter 5 to obtain a final score where a lower score is equal to a better overall performance in both independent and contextual elements.
8. Finally these scores are grouped into five tiers based on the median and the intervals between the scores. Each level receives a star rating depending on the position in the table.

Defining and Naming Statement Variables

For the sake of efficiency when viewing the tables the researcher recognizes a need to define and clarify exactly what the variables are showing and how they are represented. Each of these variables was previously presented either in the results from chapter 5 or the beginning of chapter 6. Table 6.5 lists these variables, defines them and gives them an abbreviated title for ease of recognition in the tables for this chapter.

Relationships between Operation Numbers and Information Need

States with a large amount of beef cattle operations should have greater overall topic coverage. For the first visualization, table 6.6 shows that of the top tier states for total operation amount Kansas, Alabama, and Iowa resources reflect the expressed statement by having an average total topic coverage that ranks in the top tier. This is shown by the green cells. As a reminder, average total topic coverage is an average score out of twenty for that measure across all fifty states. For each website in the

Table 6.5 Variable Definition and Clarification

Construct in Text Discussion	Definition	Table Title
Total Amount of State Beef Operations	This is the number of operations in the state that have a beef cattle herd. (Unit of measure is operation.)	Operation Total
Operation Type Percentage of Total Operations	This is a percentage of the state's operations that are classified as one of the two NAICS classifications: Beef Cattle Farming and Ranching or Feedlot (Will be reflected as %.)	Beef Cattle Farming And Ranching or Feedlot Percentage
Proportion of State Income from Beef Cattle	This is a percentage of the total agricultural income for the state that is specifically from beef cattle production. (Will be reflected as %.)	Beef Income Percentage
Economic Profile/Nass Income Classification Level	This reflects the NASS income levels discussed in Fig. 6.5 & 6.6. The smallest 3 brackets were added for each state to create a total small scale bracket and the largest three brackets combined create the large scale. (Unit of measure is operation.)	Income Bracket: Small Scale or Large Scale
Percentage of Operations with Internet Connections	This is a percentage of the state operations that report having an Internet connection out of the Operation Total. (Will be reflected as %.)	Internet Connection Percentage
Internet Access Type Percentage	This is a percentage of the operations using a specific type of Internet access out of the total number of connected operations per state. (Will be represented as %.)	(Insert Internet Type) Access Percentage
Experience Score	This is the average age in years of the primary operator plus the average number of years working at the operation. (This will be a sum score of years.)	Experience Score: High or Low
Perceived Degree of State Regulation	This is a ranking based on the numerical constructs discussed in Table 6.4. (Will be represented as a number 1-5)	Degree of Regulation
Total Information Topic Coverage	This is an average score based on the state's actual ability to cover each topic out of their potential ability to cover each topic. It is expressed as an average. (Note this is not a rank- higher is better)	Total Topic Coverage

Table 6.5 Variable Definition and Clarification Continued

Coverage of Specific Information Topic	This is a component of the Total Topic Coverage. It is a measure of the state's actual ability to cover the specific topic out of the potential 20 resources. (The unit of measure is resources and may also be represented as a % of total in cases where the independent variable is expressed as a %.)	(Insert Subject) Coverage
Use of Specific Information Type	This is a percentage of the state's actual ability to provide this specific type of resource out of the potential 20 resources. (Will be expressed as %.)	(Insert Type) Use
Use of Specific Information Format	This is a percentage of the state's actual amount of use of this specific resource format out of the potential 20 resources. (Will be expressed as %.)	(Insert Format) Use
Interactivity Level	This is a measure of the total amount of interactivity for the state. It is created by adding up the interactivity points for each resource. (Unit of measure is interactivity aspect.)	Interactivity Total
Presence of Specific Aspect of Interactivity	This is a percentage of the amount of a certain aspect of interactivity that is present out of the potential presence in the 20 state resources. (Will be expressed as %.)	(Insert Interactivity Aspect) Level
Total Relevance Score	This is a measure of the total amount of relevance for the state. Each resource is given a score of 0, 0.5, or 1. (Unit of measure is degree of relevance and is not to exceed 20 points.)	Relevance Total
Presence of Specific Aspect of Information Quality (IQ)	This is a percentage of the amount of a certain aspect of IQ that is present out of the potential presence in the 20 state resources. (Will be expressed as %.)	(Insert IQ Aspect) Level

Table 6.6 Relationship between Total Operations and Total Topic Coverage

Abbr.	Operation Total	Total Topic Coverage
TX	133924	5.3
MO	46161	11.4
OK	44106	8.4
KY	33823	9
TN	33556	9.8
AR	23385	4.9
KS	23272	19.8
AL	19685	13.2
IA	19677	15.2
VA	19596	11.5
NE	19313	5

content analysis the researcher assessed ten records. The red cells representing the scores for Texas, Arkansas, and Nebraska all have topic coverage in the lowest tier. The remaining states have yellow cells which means they have average scores for topic coverage. The only states that are doing well in this relationship are those in green: Kansas, Alabama, and Iowa.

Texas's scale of total operation to topic coverage represents a big disparity in state information available. Could there be some cultural aspects that foster this lack of content? Perhaps income levels or Internet access levels make communication through the websites less effective than other methods?

States with a large amount of beef cattle operations should have more relevant resources. Table 6.7 shows that Missouri, Kansas, Alabama, and Iowa all have a relevance total that is congruent with their large amount of operations. Texas and Arkansas have relevance in the lowest tier, and the remaining states have an average relevance as compared to their position as the top tier for total operations. It seems that the more operations there are, the more attention there needs to be in order to provide relevant content on the websites because there will be more inquiry and overall interest in successful operations. Relevance is addressed by the top tier states at a slightly better rate than average topic coverage in table 6.6, this may be related to states having a lot of relevant information on certain specific topics and not others depending on the focus of their state.

Table 6.7 Relationship between High Operation Total and Relevance Total

Abbr.	Operation total	Relevance Total
TX	133924	8
MO	46161	17.5
OK	44106	15.5
KY	33823	14.5
TN	33556	15.5
AR	23385	9.5
KS	23272	20
AL	19685	18
IA	19677	18
VA	19596	16
NE	19313	11

States with a large amount of beef cattle operations should have more information covering prevention of disease outbreaks. Table 6.8 shows that out of all the top tier states for total operation, Alabama is the one state that also has top tier coverage regarding prevention of disease outbreaks. Tennessee, Arkansas, and Nebraska are in the lowest tier and the other seven states all have average amounts. This topic is not well addressed considering the important role that these top tier states play in the success of the national beef industry.

Table 6.8 Relationship between High Operation Total and Disease Outbreak Prevention Coverage

Abbr.	Operation Total	Disease Outbreak Prevention Coverage
TX	133924	7
MO	46161	6
OK	44106	10
KY	33823	10
TN	33556	5
AR	23385	2
KS	23272	10
AL	19685	13
IA	19677	9
VA	19596	8
NE	19313	3

This finding is problematic because it shows that the topic of disease outbreaks is not very important in the states where it might be most prevalent to discuss. There may be other specific resources for the state where information about this exists, such as through veterinary offices, but it is not clear that this is the case for the majority of the states. Usually there is a link to the state animal health resources if it is available. The

absence or only moderate coverage of disease outbreak prevention communicates a lack of concern that this is an issue for the state. Could it be that states are concerned with putting too much information on a public facing website for fear that it might spark anxiety in consumers?

Operation Types: Cattle Farming and Ranching vs. Feedlot

States with a higher percentage of farming and ranching operations should have more coverage of basic information and conceptual overviews. Table 6.9 shows that Oregon, Washington, West Virginia, Virginia, and Louisiana are all providing top tier coverage of basic information and overviews of the concept. Texas is in the bottom tier in this topic. The other six states have average coverage of basic information topics. The rationale behind this statement is that cattle farming and ranching operations should have more basic information and conceptual overview of the process content available to them because these are often smaller operations with more remote circumstances. The operators may not have been required to use the identification in the past or they may not see the point in doing it if there is not a direct return on investment. Basic information will illuminate these factors and help dispel other skepticisms. Texas stands out as scoring low in this measure as well, which follows with the state's overall small amount of topic coverage and relevance.

States with a higher percentage of feedlot operations should have more information topics dealing with market benefits, market risks, and types of technology.

Table 6.9 Relationship between High Cattle Farming and Ranching Percentage and Basic Information Coverage

Abbr.	Cattle Farming and Ranching Percentage	Basic Info/Overview Coverage
CA	100%	6%
TN	100%	6%
OR	99%	13%
WA	97%	6%
TX	95%	1%
FL	94%	15%
AR	94%	5%
CO	93%	4%
WV	93%	11%
OK	93%	6%
VA	93%	10%
LA	93%	10%

Table 6.10 shows the two information topic categories discussing technology and discussing market benefits and risks related to implementation. Iowa and Michigan score in the top tier for discussion of technology and there is a larger portion in the lowest tier including Nebraska, South Dakota, Illinois, and Ohio. Minnesota, South Dakota, and Indiana score highest in discussion of market risk and benefit and the lowest tier is represented with Wisconsin, Nebraska, Illinois, and Rhode Island. Pennsylvania is average across both measures.

The rationale behind this relationship is that states with higher proportions of feedlot operations will need more information about the technology related to traceability because they have greater need for technological assistance to manage the larger scale operation and they also have better means by which to access it.

Table 6.10 Relationship between High Feedlot Percentage and Coverage of Technology and Market Risks and Benefits

Abbr.	Feedlot Percentage	Technology Coverage	Market Risk and Benefit Coverage
IA	11%	30%	5%
MN	8%	23%	20%
WI	7%	15%	0%
PA	6%	15%	10%
NE	6%	8%	3%
IL	5%	5%	3%
SD	5%	5%	23%
MI	4%	40%	5%
RI	3%	15%	0%
OH	3%	5%	10%
IN	3%	10%	18%

Additionally market risk from not implementing and benefits from implementing address the mindset of the feedlot operation where more emphasis will be placed on facilitating market sales of the cattle as meat. Consumer views and constraints based on factors related to traceability compliance are going to be of greater importance to individuals with this perspective.

These two topics are not as well addressed as they should be. A lot of high feedlot states score in the lowest tier. This communicates that these states are not addressing specific elements that are highly important to the operations in their state; however, this is hard to state directly given the high level of beef cattle farming and ranching operations over all the states – even those with a large amount of feedlots.

States with a higher percentage of cattle farming and ranching operations should have more information using images and resource collections. Table 6.11 shows that all top tier states for cattle farming and ranching have an average or high level of resource collection use. Louisiana and Oregon score high in both collections and images/still images. For image and still image, Tennessee also scores high, but there are also a large number of states in the lowest tier including: Texas, Florida, Arkansas, and West Virginia. California and Virginia scored an average amount across both information types.

It is important to note that part of the reason the states will score lower in the image and still image category is that these particular states are also lower in economic income level overall and have slower Internet access options for their operations. In the

Table 6.11 Relationship between High Cattle Farming and Ranching Operations and Use of Collections and Images as Information Types

Abbr.	Cattle Farming and Ranching Percentage	Collection Use	Image and Still Image Use
TN	100%	35%	60%
CA	100%	35%	33%
OR	99%	70%	48%
WA	97%	75%	40%
TX	95%	60%	23%
FL	94%	65%	25%
AR	94%	35%	3%
CO	93%	95%	43%
WV	93%	35%	20%
OK	93%	75%	30%
VA	93%	60%	43%
LA	93%	80%	53%

instances where this is not the case, the use of images has the ability to enhance the user experience especially when the user does not have time to sort through text instructions. Visual resources are also incredibly important to comprehension of information especially in areas such as Texas where there may be a larger portion of non-English speaking cattle producers.

Economic Profile: The Importance of Beef Cattle Income to the State

States with a large beef cattle income as a percent of the total state income should have greater overall topic coverage. Table 6.12 shows that Colorado, Kansas, and Idaho are states within the top tier of the beef income percentage that also have a top tier score for average total topic coverage. Wyoming, Texas, Nebraska, Montana, and South Dakota score in the lowest tier for average total topic coverage. The remaining five states in the top tier for income provide average topic coverage.

The importance of this measure is that the greater income the state is generating as a result of beef cattle operations, the more financial risk is involved when problems arise. Overall the top tier states in this category are not doing a good job in average topic coverage. States need to use some of this income generated to create resources that focus more fully on all the aspects of traceability and identification to safeguard financial futures of the state operations. States with a high beef cattle income as a percent of total state income should have more relevant resources. Table 6.13 shows that Colorado, Kansas, Idaho, and Missouri are states within the top tier of income percentage that also have top tier amount of relevant resources. Wyoming,

Table 6.12 Relationship between High Beef Income Percentage and Amount of Total Topic Coverage

Abbr.	Beef Income Percentage	Total Topic Coverage
WY	65%	6.3
CO	56%	18.5
KS	55%	19.8
TX	51%	5.3
OK	48%	8.4
NE	44%	5
MT	42%	4.2
NV	32%	11.3
SD	29%	5.9
WV	27%	8
NM	25%	8.3
ID	23%	14.9
MO	21%	11.4

Table 6.13 Relationship between High Beef Income Percentage and Total Relevance of Resources

Abbr.	Beef Income Percentage	Relevance Total
WY	65%	8.5
CO	56%	17
KS	55%	20
TX	51%	8
OK	48%	15.5
NE	44%	11
MT	42%	8
NV	32%	16
SD	29%	10.5
WV	27%	11
NM	25%	12.5
ID	23%	18
MO	21%	17.5

Texas, Montana, and South Dakota score in the lowest tier for amount of relevant resources. The remaining five states have average relevance scores. Again, the income level relationship with relevance is slightly better than the relationship with topic coverage shown in table 6.13, which communicates that the states address certain topics with greater detail than others.

Economic Profile: The Needs of Small Scale vs. Large Scale Producers

States with more small scale operations should have more information topics addressing cost, liability, and privacy. Table 6.14 shows the top tier states that have a high percentage of their total operations in the smallest three economic income categories in relationship to how well those states cover topics related to liability, cost,

Table 6.14 Relationship between High Small Scale Income Bracket Operations and Coverage of Liability/Risk, Cost/Affordability, and Privacy

Abbr.	Small Scale Income Bracket	Liability/Risk Coverage	Cost/Affordability Coverage	Privacy Coverage
CT	65%	5%	40%	5%
AZ	63%	0%	10%	5%
FL	60%	5%	10%	10%
NH	59%	0%	0%	0%
HI	58%	5%	0%	5%
WA	57%	0%	20%	15%
MA	57%	0%	0%	0%
RI	55%	0%	0%	0%
NM	54%	5%	5%	5%
ME	52%	0%	5%	0%
OR	49%	5%	15%	5%

and privacy as they pertain to identification and traceability. None of these states have a top tier level of coverage regarding the topic of liability or risk and the majority do not have any coverage. Connecticut, Arizona, Florida, Washington, and Oregon all have greater coverage of cost and affordability while New Hampshire, Hawaii, Massachusetts, and Rhode Island do not cover the topic. Finally, Florida and Washington are the two states that have top tier coverage on the topic of privacy, while New Hampshire, Massachusetts, Rhode Island, and Maine do not have any coverage. New Mexico has an average amount of topic coverage in all three of the issues.

The limited coverage of liability/risk and privacy among these small scale states echoes the findings from past research showing that the two topics are major concerns for producers. The cost/affordability coverage level is more constant and consistent with the position of these producers as operators of very small farms. The states are addressing affordability in some cases, but it will continue to be a concern.

States with more small scale operations should also have more information addressing myths and misinformation. Table 6.15 shows the states with the largest percent of smallest scale operations out of the total operations for the state in relationship with the states level of discussion related to dispelling myths and misinformation. The majority of these states do not address this issue at all. Oregon and New Mexico score in the top tier. Washington is the only state that delivers an average amount on dispelling myths and misinformation.

Table 6.15 Relationship between High Small Scale Income Bracket Operations and Coverage of Myths and Misinformation

Abbr.	Small Scale Income Bracket	Myths and Misinformation Coverage
CT	65%	0%
AZ	63%	0%
FL	60%	0%
NH	59%	0%
HI	58%	0%
WA	57%	3%
MA	57%	0%
RI	55%	0%
NM	54%	5%
ME	52%	0%
OR	49%	13%

There are a lot of rumors and misperceptions about traceability and identification among certain groups and communities. This is true in all avenues of work and life and is prevalent among rural agricultural producers in the smaller economic categories who may have much deeper rooted informal networks of communication among their peers and family than individuals working in other careers. These misconceptions and misinformation can spread and perpetuate unless there are authoritative channels with which to dispel these myths.

There is little instance when states are providing this information to the smallest scale states, which may contribute to opposition from certain communities whose views are not addressed or challenged. One example of a myth or misconception that perpetuates among some producers is that the COOL regulation or Country of Origin Labeling does away with the need for traceability measures; however, COOL is not about biosecurity and food safety. Instead it is a marketing tool for consumers (House Committee on Agriculture, 2015, May 20; Schulz & Tonsor, 2010).

States with more large scale operations should have more information topic coverage of market benefit and risk, national biosecurity measures, and technology. Table 6.16 shows that of the top tier states that have the most operations in the large scale income bracket, the topic of market benefit and risk gets a large amount of coverage. South Dakota, North Dakota, Montana, Kansas, and Minnesota all rank in the top tier for this topic. Nebraska, Delaware, Illinois, and Wyoming have little to no coverage for market risk and benefit. North Dakota, Iowa, and Kansas, all have the

Table 6.16 Relationship between Higher Large Scale Income Bracket Operations and Coverage of Market Risks and Benefits, Technology, and National Biosecurity Measures

Abbr.	Large Scale Income Bracket	Market Risk and Benefit Coverage	Technology Coverage	National Biosecurity Coverage
SD	37%	23%	5%	5%
ND	35%	23%	30%	15%
IA	34%	5%	30%	30%
NE	31%	3%	8%	15%
MT	26%	13%	3%	0%
DE	24%	0%	10%	25%
IL	22%	3%	5%	0%
WY	20%	0%	5%	30%
NV	20%	8%	18%	10%
KS	19%	50%	45%	50%
MN	15%	20%	23%	35%

largest amount of technology topic coverage, though the majority of the states: South Dakota, Nebraska, Montana, Illinois, and Wyoming score in the lowest tier for technology coverage. National biosecurity information is covered the most in Iowa, Wyoming, Kansas, and Minnesota; however, there is little to no coverage in this area from South Dakota, Montana, and Wyoming. For all three of the topics, Nevada covers each topic an average amount. All three categories are lacking given that they could be considered the most salient topics for the producers in these states. Perhaps the information from the websites is still more heavily geared toward lower economic category operations since none of the large scale income bracket percentages is above 50% of the total beef operations.

States with more small scale operations should have more standard information formats such as HTML, PDF, and RTF. Table 6.17 shows the relationship between the top-tier states that have the most operations in the small scale income bracket and the total standard formats used. This relationship is important to consider because smaller scale operations may not have access to software that will read other proprietary formats such as PowerPoint or Excel. The total for standard formats is calculated by adding up state scores for PDF, RTF, and HTML formats used in the resources and taking a percentage from the total resources retrieved for each state. The majority of all states use a standard format for the majority of the resources on their websites. Connecticut, Arizona, Florida, New Hampshire, Washington, and Oregon are the top tier small scale

Table 6.17 Relationship between High Small Scale Income Bracket Operations and Use of Standard Information Formats

Abbr.	Small Scale Income Bracket	Standard Format Use
CT	65%	100%
AZ	63%	100%
FL	60%	100%
NH	59%	100%
HI	58%	90%
WA	57%	100%
MA	57%	85%
RI	55%	95%
NM	54%	82%
ME	52%	85%
OR	49%	100%

income bracket states where all retrieved resources are delivered using standard formats. The other states also have an average amount of standard format use.

This relationship is more positive in alignment than the majority of the other relationship statements in the analysis. Overall it seems that the state websites have paid attention to providing formats that are standard and easily accessible without the use of proprietary software. Part of this could be that these resources will then be more likely to be available in the system into the future and this fosters a longer term of sustainability for the website.

States with more small scale operations should have more information covering issues of personal financial gain related to implementation. Table 6.18 shows the relationship between the top tier small scale states and the states' coverage of personal financial gain related to implementation. Only Hawaii is in the top tier for coverage of this topic. Arizona, Washington, Massachusetts, and Rhode Island do not address this topic. The majority of the small scale states have an average level of coverage.

The rationale behind this statement is that information about potential personal financial gain related to implementation may open up opportunities for financial advancement associated with the implementation such as through a value-added or beef quality assurance program. Giving these smallest scale operations alternative opportunities will communicate not only positive aspects of identification practices, but also an interest in the livelihood of those smaller scale operations. There is little coverage of this for these small scale income bracket states and incidentally producers

Table 6.18 Relationship between High Small Scale Income Bracket Operations and Coverage of Information about Personal Financial Gain Related to Implementation

Abbr.	Small Scale Income Bracket	Personal Financial Gain Coverage
CT	65%	5%
AZ	63%	0%
FL	60%	5%
NH	59%	5%
HI	58%	15%
WA	57%	0%
MA	57%	0%
RI	55%	0%
NM	54%	10%
ME	52%	5%
OR	49%	5%

of these states may not be aware of the market avenues available to them or how to get involved.

Internet Access: Relationships to Format and Level of Interactivity

States with a smaller percent of Internet connected operations out of their total operations should utilize the PDF information format more often. Table 6.19 shows the relationship between the operations with the least amount of Internet connected operations to their use of PDF as the format of choice for the retrieved resources. The majority of these states with low level of Internet connected operations have some use of the PDF format, but only one state, Alaska, has a usage percent in the top tier level. Illinois uses no PDF format and Arizona, New Mexico, North Dakota, and Maryland also score in the lowest tier for the use of PDF. The other six states provide an average amount of PDFs.

Table 6.19 Relationship between Low Internet Connection Percentage and Use of PDF as Format

Abbr.	Internet Connection Percentage	PDF Use
DE	25%	55%
AZ	34%	9%
IL	40%	0%
PA	43%	42%
NM	43%	24%
ND	43%	30%
AK	44%	90%
IA	44%	60%
NH	45%	45%
OH	46%	35%
MD	46%	10%
IN	47%	60%

This is a fairly important aspect of access as HTML resources do not always print effectively or efficiently. PDFs are already in an accessible format for print material. This aspect does not appear to be a concern for these states with the lowest amount of Internet connected operations per total operations. This suggests that those producers without Internet access are not seeking out printable resources from these websites. Perhaps many of these producers who are not Internet connected do not use these web channels as resources. In many cases they will not see the Internet as a trustworthy channel. More qualitative study is needed to assess this suggestion.

States with a larger percent of Internet connected beef cattle operations should have greater overall topic coverage and interactivity level. Table 6.20 looks at the top tier states for the greatest percentage of Internet connected operations in relation to the measures for total topic coverage and total interactivity for the states. Oregon, Washington, Colorado, and Idaho are all states with a top level of topic coverage. Wyoming, Montana, and Texas score in the lowest tier. Washington and Florida both have a high level of interactivity, while Idaho, Wyoming, Montana, and Oklahoma are all in the lowest tier for interactivity. California and Tennessee have an average level of for both topics and interactivity.

There is greater average topic coverage among states with more Internet connected operations than there is attention to interactivity. This makes sense because the provision of information is more often top down communication and less of a two way discussion. Higher interactivity levels will be applicable to these higher levels of

Table 6.20 Relationship between Internet Connection and Total Topic Coverage plus Total Interactivity

Abbr.	Internet Connection Percentage	Total Topic Coverage	Interactivity Total
CA	80%	10	24
OR	78%	14.2	38
WA	75%	16.8	40
CO	74%	18.5	35
ID	68%	14.9	14
WY	67%	6.3	17
MT	64%	4.2	15
TX	63%	5.3	27
TN	63%	9.8	32
FL	63%	11.4	44
OK	62%	8.4	14

Internet connection and will involve more two way dialogue and producer input; however, this also creates needs for proper management of the complexity of that dialogue and calls for increased maintenance in the supporting infrastructure. There are more costs and time that will need to be put into management post implementation. This may be difficult for the state and Extension budgets to provide, and it may be that there is little opinion among administrators that interactivity will actually be useful given the demographic that they serve.

Internet Access: Types of Connection Dictate Elements of Accessibility

States with high numbers of mobile users should have websites that are compatible with mobile devices. This corresponds to the usability and design item: "The font size is not fixed or too small." Table 6.21 shows the top tier states for mobile internet connections out of total connected operations per state in comparison with the usability and design component that relates to mobile compatibility of web content. Michigan, Delaware, Tennessee, and Virginia all have top tier scores for this information quality element. South Carolina, Illinois, and California all have low scores for mobile compatibility. The remaining six top mobile states have an average level of compatibility.

This is a measure of great importance when it comes to assessing the ability of producers to utilize mobile devices to access the information. The results here suggest that not all of the states that have these large amounts of mobile Internet connected users have resources that these individuals can actually access effectively. If this

Table 6.21 Relationship between High Mobile Access Percentage and Level of Resource Mobile Compatibility

Abbr.	Mobile Access Percentage	Font Size is Not Fixed or Too Small - Level
MI	23%	100%
AZ	23%	50%
DE	23%	90%
MD	22%	50%
IN	22%	80%
AK	22%	85%
SC	21%	15%
OK	21%	50%
IL	21%	0%
TX	20%	85%
CA	20%	40%
TN	20%	100%
VA	20%	90%

information were to contain important emergency response or disease outbreak topics the inability to access this information resource could be a major disadvantage to a mobile user. The researcher suggests that this is an area of increasing importance as mobile technology becomes increasingly ubiquitous in agricultural production. To continue to have non-mobile compliant web material becomes a larger issue of information equity.

States with high numbers of mobile users should have greater interactivity levels and more specifically, should offer interactive media or applications for wireless devices. Table 6.22 shows the top tier states for percentage of mobile users in comparison with the interactivity element “offers interactive media or applications for wireless devices.” Arizona, Maryland, and Illinois all score a top percentage for this element while Alaska, South Carolina, and Oklahoma are all in the lowest tier. The majority of the states provide an average amount of interactive media or wireless apps.

This relationship is important because it shows whether states are acknowledging the most practical media and ways of working with mobile devices. The majority of the states have an average amount, which suggests that states are starting to integrate some of these elements into their websites. Part of this will depend on whether the website has been recently updated; however, it also is contingent on whether there is a willingness to learn, monitor, and manage these applications and media.

States with high numbers of dial-up Internet users should have fewer images and

Table 6.22 Relationship between High Mobile Access Percentage and Level of Available Interactive Media and Applications for Wireless Devices

Abbr.	Mobile Access Percentage	Interactive Media or Applications for Wireless Devices- Level
MI	23%	30%
AZ	23%	50%
DE	23%	45%
MD	22%	50%
IN	22%	20%
AK	22%	5%
SC	21%	0%
OK	21%	5%
IL	21%	100%
TX	20%	20%
CA	20%	20%
TN	20%	15%
VA	20%	15%

especially moving images used as information types. Table 6.23 shows the states that have the most dial-up as a percentage of their overall Internet connected beef operations in relation to the state's use of images and still images. Wisconsin scores well with little use of images or moving images. In comparison, Alaska and Tennessee use high numbers of images in relation to their high percentage of dial-up users. Ohio and Tennessee both provide an average amount moving images while the majority of states score high with no use of moving images. A majority of the states with high dial-up rates also score lowest with the high usage of still images in their material. Missouri and Ohio score high here for low use of still images.

Table 6.23 Relationship between High Dial-up Access Percentage and Use of Images, Still Images, and Moving Images

Abbr.	Dial-Up Access Percentage	Image Use	Moving Image Use	Still Image Use
DE	24%	25%	0%	35%
MI	17%	40%	0%	50%
AK	17%	65%	0%	50%
MO	15%	50%	0%	20%
WV	14%	30%	0%	45%
MS	14%	35%	0%	65%
OH	13%	25%	5%	20%
WI	12%	15%	0%	25%
IN	12%	35%	0%	75%
TN	12%	60%	5%	60%
VA	12%	35%	0%	30%
NY	12%	25%	0%	50%

For states with the highest dial-up percentage as a total of Internet connected operations lower levels of images, still images, and moving images mean that all the state users will have a better opportunity to access content and communications available to them. This attention can be seen in the small amounts of moving images available because this type is the most problematic for lower speed connections. Images and still images must not be as much of an issue since there seems to be little attention to limiting these in high dial-up areas. This relationship is similar to the issue of mobile compatibility. When states do not take this access constraint into consideration it can increase the inequity of the information channels to all producers in that state and ultimately becomes a larger social justice consideration.

Experience Scores: A Picture of Some Subtle Implications

States with a lower experience score should have more content covering how-tos and instructions as well as basic information. Table 6.24 looks at the experience score of the primary operators of the state with the amount of topic coverage of the issues of both how-tos and instructions and basic information/conceptual overviews of identification and traceability. North Carolina scores high as a state with lower experience that has high discussion of both topics. North Dakota is in the lowest tier for how-tos and instructions, but it scores in the highest tier for basic information. Rhode Island is the one state that scores low for basic information, and Iowa is the final high tier state for basic information. Delaware, New Hampshire, Indiana, and Arkansas are average providers across both topics.

Table 6.24 Relationship between Low Experience Score and Coverage of Instructions and Basic Information

Abbr.	Low Experience Score	How-Tos and Instructions Coverage	Basic Info/Overview Coverage
DE	75.2	13%	4%
RI	75.7	11%	1%
NC	78.45	14%	10%
NH	78.7	9%	6%
IA	79.4	11%	10%
IN	80.2	6%	8%
MN	80.25	19%	13%
AR	80.4	9%	5%
ND	80.65	5%	13%

While the variations in experience are very small it is still important to acknowledge the attention to content that may be better suited for states where there is a lower average experience level. Inexperienced operators with new operations are going to need instructions and authoritative information on why traceability is an important aspect of their cattle management plans. The majority of the state website materials are less concerned with the instruction aspect of identification and traceability efforts. Perhaps this is because there is a perception that the producers are already getting this instruction elsewhere. What other channels both online and off provide this information? Would a new farmer have access to these channels? Not necessarily. There will be a lot of barriers to entry for new producers in some information networks. Having this information available at the state level will increase understanding about how and why to implement traceability and to learn more about the Animal Disease Traceability (ADT) regulations.

States with a lower experience score should have more images and resource collections to provide more complex and visual understanding of the issues. Table 6.25 looks at the top low experience score of the states in comparison with the state's usage of resource collections and images as information types. New Hampshire is the only top tier state for providing resource collections, while Rhode Island, North Carolina, and Indiana are all in the lowest tier for this measure. Iowa and Minnesota are top providers of images and still images, while Rhode Island and Arkansas are lowest tier providers of

Table 6.25 Relationship between Low Experience Score and Use of Collections and Images as Information Types

Abbr.	Low Experience Score	Collection Use	Image and Still Image Use
DE	75.2	55%	30%
RI	75.7	20%	10%
NC	78.45	25%	38%
NH	78.7	75%	40%
IA	79.4	50%	50%
IN	80.2	15%	40%
MN	80.25	50%	55%
AR	80.4	35%	3%
ND	80.65	40%	35%

this type. Delaware and North Dakota score at an average level for both information type use.

It is interesting to note that the states with the lowest experience level have only average use of collections and images, yet these types of resources will be important modes of information for the producers with less experience. Having the visual cues to accentuate the content delivered in the text helps deliver a quicker, clearer understanding. Having additional avenues that are recommended by an authoritative source save the new producer a lot of searching and the personal process of vetting materials to find trustworthy salient material. It is important to note that, with the exception of Delaware, these states are not states with high percentages of dial-up users which might change the level at which the state would want to produce image rich material.

Degree of State Regulation: Perceived Regulatory Levels

States with a higher perceived degree of state regulation should also have a higher attention to the information topic guidelines and regulations. Table 6.26 shows the top tier level of perceived degree of regulation in relation to the amount of resources where the state discusses the topic of guidelines and regulations. Michigan, Washington, Colorado, Iowa, Missouri, Utah, and Wisconsin all have top tier scores for topic coverage. Nebraska, Oklahoma, South Dakota, and Texas are in the lowest tier. The remaining eleven top tier states for regulation have average coverage of the topic.

This is an important relationship to assess because to communicate a high

Table 6.26 Relationship between a High Degree of Regulation and Coverage of Guidelines and Regulations

Abbr.	Degree of Regulation	Guidelines and Regulations Coverage
MI	5	45%
WA	5	39%
AL	4	30%
CA	4	21%
CO	4	31%
FL	4	29%
IA	4	35%
IN	4	18%
ME	4	18%
MO	4	36%
MS	4	16%
NC	4	25%
ND	4	30%
NE	4	11%
NJ	4	16%
NY	4	28%
OK	4	15%
SD	4	3%
TX	4	6%
UT	4	33%
VA	4	21%
WI	4	34%

degree of regulation without providing information about the specific elements and guidelines for compliance will cause confusion and skepticism among those seeking information from the state websites. There is an average level of alignment to the relationship statement, higher in the highest level. States that score in the lowest tier for topic coverage with such a high perception of regulation will need to provide more accessible resources about the regulations from the search engine query to avoid confusion and frustration and to promote understanding of the rationale and components of the regulation. Consequences are seldom discussed in any state's coverage of guidelines and regulations. This omission is significant because not knowing specific consequences may foster continued lack of compliance by producers who are reluctant already.

States with a higher perceived degree of state regulation will also be states with a larger amount of total beef cattle operations and a larger percent of income from beef cattle. Table 6.27 shows the highest level of perceived degree of regulation in conjunction with percentage of income from beef out of the total income from agriculture for the state. Colorado, Missouri, Nebraska, Oklahoma, South Dakota, and Texas all have a top tier income percentage while Maine, North Carolina, and New Jersey are in the lowest tier for income percentage. The majority of the states are average in their income from beef.

This table is slightly different than the others because the relationship is looking at two profile areas; however, it is important to see if this communicated level of

Table 6.27 Relationship between a High Degree of Regulation and Beef Income Percentage

Abbr.	Degree of Regulation	Beef Income Percentage
MI	5	7%
WA	5	11%
AL	4	8%
CA	4	8%
CO	4	56%
FL	4	7%
IA	4	15%
IN	4	5%
ME	4	4%
MO	4	21%
MS	4	5%
NC	4	3%
ND	4	10%
NE	4	44%
NJ	4	1%
NY	4	8%
OK	4	48%
SD	4	29%
TX	4	51%
UT	4	20%
VA	4	19%
WI	4	12%

operator regulation has any correlation with the percent income from beef. These states will experience greater loss in the event of a disease outbreak. Though the income is average compared to the perceived regulation for the state there are some states that are higher income that also have high degree of perceived regulation. States not listed that have a high degree of income from beef out of their total state agriculture income will want to take steps to work with state producers to better provide a sense of the importance of regulation and an accurate picture of the need for regulation as a counter to disease risk.

States with a higher perceived degree of state regulation should also be states with a high score in currency as a measure of information quality. Table 6.28 compares the top tier states for perceived degree of regulation with the state's score for currency of the information provided. Alabama, Florida, Wisconsin, Missouri, Oklahoma, and Nebraska all have top tier levels of currency. Mississippi, New Jersey, and California all have low tier scores for currency. The remaining thirteen states have average levels of currency.

Currency is an important component to perceived degree of regulation because less current and consequently less accurate information may in fact be the reason for the higher perceptions of regulation. Lack of currency is ineffective in communicating the appropriate regulatory information to the producers and can affect the levels of trust by undermining the perceived level of authority. The top tier states are not as current as they could be, especially the states that score a five for high degree of

Table 6.28 Relationship between High Degree of Regulation and Level of Currency

Abbr.	Degree of Regulation	Currency Level
MI	5	57%
WA	5	55%
AL	4	75%
FL	4	68%
WI	4	67%
MO	4	65%
OK	4	62%
NE	4	60%
SD	4	58%
IN	4	57%
TX	4	53%
ME	4	52%
ND	4	52%
IA	4	50%
CO	4	47%
NC	4	45%
NY	4	43%
VA	4	38%
UT	4	37%
MS	4	35%
NJ	4	27%
CA	4	25%

regulation.

The majority of the states listed in the top tier for perceived regulation need to focus on making current information the easiest to retrieve. It may be that because there is already information on this issue the state websites have not updated resources to reflect a date within two years of the current date. By not doing this, the retrieved results are bogged down with old resources. A producer may not spend the time (or may not have the time) to sort through the old resources. Potentially a website visitor will not look at the date of the resource (if the date is available) and thus, many producers will be in the dark about their status of compliance with current state and federal regulations. This is a major disconnect when viewed in conjunction with the perception of regulation.

Visualizing Total State Performance Based on Contextual Factors

Table 6.29 shows the total state performance based on the contextual factors outlined in the previous relationship comparisons. Each state's position was achieved by the process laid out at the beginning of chapter 6 where the state is given a point whenever the comparisons between the independent and dependent variables in the statement yield a green cell. These points are then totaled and the final rank is based on the amount. The lower the state is numerically in the ranks, the higher the state scores in contextual factor performance.

There are a lot of states that score low on contextual measures that have a reputation for being major players in the beef industry. These states need greater

Table 6.29 Total State Performance Based on Contextual Factors

State	Abbr.	Context Rank
Iowa	IA	1
Florida	FL	2
Kansas	KS	2
Missouri	MO	2
Oregon	OR	2
Washington	WA	2
Colorado	CO	3
Minnesota	MN	3
Alabama	AL	4
Michigan	MI	4
Wisconsin	WI	4
Idaho	ID	5
Louisiana	LA	5
North Dakota	ND	5
Oklahoma	OK	5
South Dakota	SD	5
Virginia	VA	5
Arkansas	AR	6
Arizona	AZ	6
Connecticut	CT	6
Delaware	DE	6
Indiana	IN	6
North Carolina	NC	6
Nebraska	NE	6
New Hampshire	NH	6
Tennessee	TN	6
West Virginia	WV	6
Alaska	AK	7
Hawaii	HI	7
Illinois	IL	7
Maryland	MD	7
Mississippi	MS	7
Montana	MT	7
New Mexico	NM	7
New York	NY	7
Ohio	OH	7
Texas	TX	7
Utah	UT	7
Wyoming	WY	7
California	CA	8
Georgia	GA	8
Kentucky	KY	8
Massachusetts	MA	8
Maine	ME	8
New Jersey	NJ	8
Nevada	NV	8
Pennsylvania	PA	8
Rhode Island	RI	8
South Carolina	SC	8
Vermont	VT	8

attention in an effort to provide better resources for the producers of their state. Producers of one state can and probably do go to other state's websites for information. If users struggle with access to information on their own; however, this takes away the chance for the producer to have access to information that is state specific. There may not currently be an urgent need for states to communicate state specific information to producers in a timely manner, but it is important that states are prepared for the possibility that this might occur.

A lot of the material in the biosecurity and agroterrorism literature convey the sentiment that it is not a question of if, but a question of when, and how prepared will we be to deal with the outbreak of disease. In communicating to the producers of the state, this is a philosophy that will help information system administrators and producers to be proactive instead of reactive with a sense of efficacy in their ability to seek and find answers to questions when they need them.

Following the creation of the contextual ranks in table 6.29, the researcher combines the independent state ranks from the previous chapter 4 content with the contextual ranks and then combines all of these scores to get an overall rank sum for each of the fifty states. Table 6.30 shows the two scores (the independent rank and the context rank) coming together to create a sum rank for each state. One may wonder about the states that are not commonly represented in the contextual assessment scoring equally with states that appear often. States that are not represented in the contextual scores do not have the same level of need for that particular issue and will be

Table 6.30 Creating an Overall Rank Score for Each State

State	Abbr.	Independent Rank	Context Rank	Sum
Washington	WA	22.4	2	24.4
Florida	FL	28.85	2	30.85
Utah	UT	25.9	7	32.9
North Dakota	ND	27.95	5	32.95
Alabama	AL	30.05	4	34.05
Ohio	OH	27.55	7	34.55
Maryland	MD	27.75	7	34.75
Colorado	CO	33.55	3	36.55
Louisiana	LA	32.4	5	37.4
Iowa	IA	36.85	1	37.85
Kansas	KS	35.95	2	37.95
New Hampshire	NH	33.35	6	39.35
Missouri	MO	37.55	2	39.55
Wisconsin	WI	36.5	4	40.5
Oregon	OR	39	2	41
Michigan	MI	39.45	4	43.45
Illinois	IL	36.9	7	43.9
Georgia	GA	36.35	8	44.35
Tennessee	TN	41.35	6	47.35
Nevada	NV	42.15	8	50.15
Minnesota	MN	47.65	3	50.65
South Dakota	SD	45.7	5	50.7
Delaware	DE	44.9	6	50.9
Vermont	VT	42.9	8	50.9
Maine	ME	43.8	8	51.8
Hawaii	HI	45.1	7	52.1
Virginia	VA	47.35	5	52.35
Indiana	IN	47.65	6	53.65
North Carolina	NC	49.25	6	55.25
Idaho	ID	50.55	5	55.55
Connecticut	CT	50.6	6	56.6
Kentucky	KY	49.55	8	57.55
New Jersey	NJ	51.2	8	59.2
Nebraska	NE	54.55	6	60.55
Oklahoma	OK	56.2	5	61.2
New Mexico	NM	55.75	7	62.75
Mississippi	MS	61.85	7	68.85
Rhode Island	RI	62.85	8	70.85
Texas	TX	66.15	7	73.15
New York	NY	66.75	7	73.75
California	CA	65.85	8	73.85
Alaska	AK	67.85	7	74.85
Massachusetts	MA	70.5	8	78.5
Pennsylvania	PA	72.65	8	80.65
Arkansas	AR	76.45	6	82.45
Arizona	AZ	77	6	83
West Virginia	WV	78.1	6	84.1
South Carolina	SC	77.95	8	85.95
Montana	MT	82.25	7	89.25
Wyoming	WY	82.3	7	89.3

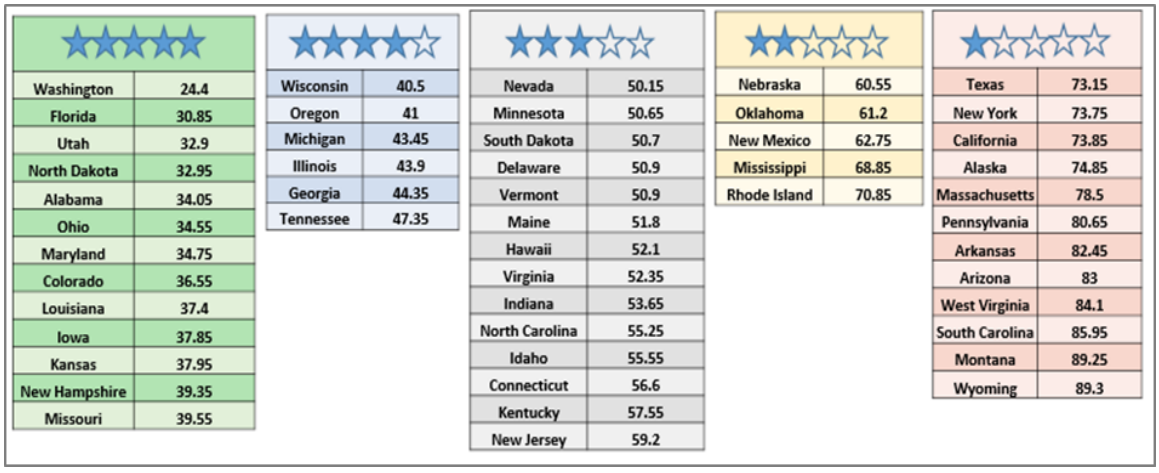
represented as higher if they do indeed provide a higher level of access factors by their rank in the independent categories. The top section represented in green has a five star rating. These are the states that perform the best overall in both independent measures and contextual measures. Lower scoring states should look to other states with similar demographics and industry related issues to get ideas about ways that will improve their overall rating.

The second tier states in blue are above average with a four star rating. These states may need more work in specific areas, but they are for the most part providing solid access to the users in their state. These state websites will also be beneficial for other states in the lower tiers to look to for ways to improve their ranking. Third tier states have an average ranking with three stars. These states need to improve in multiple instances, but there is a solid amount of capability for producers to gain information. States in the yellow section have a two-star or below average rating. These states are lacking quality in multiple areas. Producers will experience some difficulty in finding resources that best meet their needs. These states will want to take steps to improve their deficient areas by looking at the areas where they are lacking.

States in the red section score the lowest with one star. These states do not have a lot of content that is effectively available for the producers of this state. The researcher suggests that these states take time to evaluate and update the two state web channels because they are not good sources of information about traceability and identification for cattle producers. Additionally, administrators will want to look at the

demographic characteristics of their states in further detail to understand the best possible vehicles for transmission of this information. Without taking these steps these websites perpetuate an overall misunderstanding of what is available and what steps need to be taken and that there are channels of communication out there that are intended for communicating with producers.

Figure 6.13 is another view of the states as they fall under their specific star rank with just the final score. By color coding the states on the map shown in figure 6.14, one can see how these states relate geographically to one another. This will be helpful for individuals dealing with transportation of cattle across state lines. States will be able to share resources or ideas with similar or surrounding states.



★★★★★	
Washington	24.4
Florida	30.85
Utah	32.9
North Dakota	32.95
Alabama	34.05
Ohio	34.55
Maryland	34.75
Colorado	36.55
Louisiana	37.4
Iowa	37.85
Kansas	37.95
New Hampshire	39.35
Missouri	39.55

★★★★☆	
Wisconsin	40.5
Oregon	41
Michigan	43.45
Illinois	43.9
Georgia	44.35
Tennessee	47.35

★★★☆☆	
Nevada	50.15
Minnesota	50.65
South Dakota	50.7
Delaware	50.9
Vermont	50.9
Maine	51.8
Hawaii	52.1
Virginia	52.35
Indiana	53.65
North Carolina	55.25
Idaho	55.55
Connecticut	56.6
Kentucky	57.55
New Jersey	59.2

★★☆☆☆	
Nebraska	60.55
Oklahoma	61.2
New Mexico	62.75
Mississippi	68.85
Rhode Island	70.85

★☆☆☆☆	
Texas	73.15
New York	73.75
California	73.85
Alaska	74.85
Massachusetts	78.5
Pennsylvania	80.65
Arkansas	82.45
Arizona	83
West Virginia	84.1
South Carolina	85.95
Montana	89.25
Wyoming	89.3

Figure 6.13 State Rank Star Chart

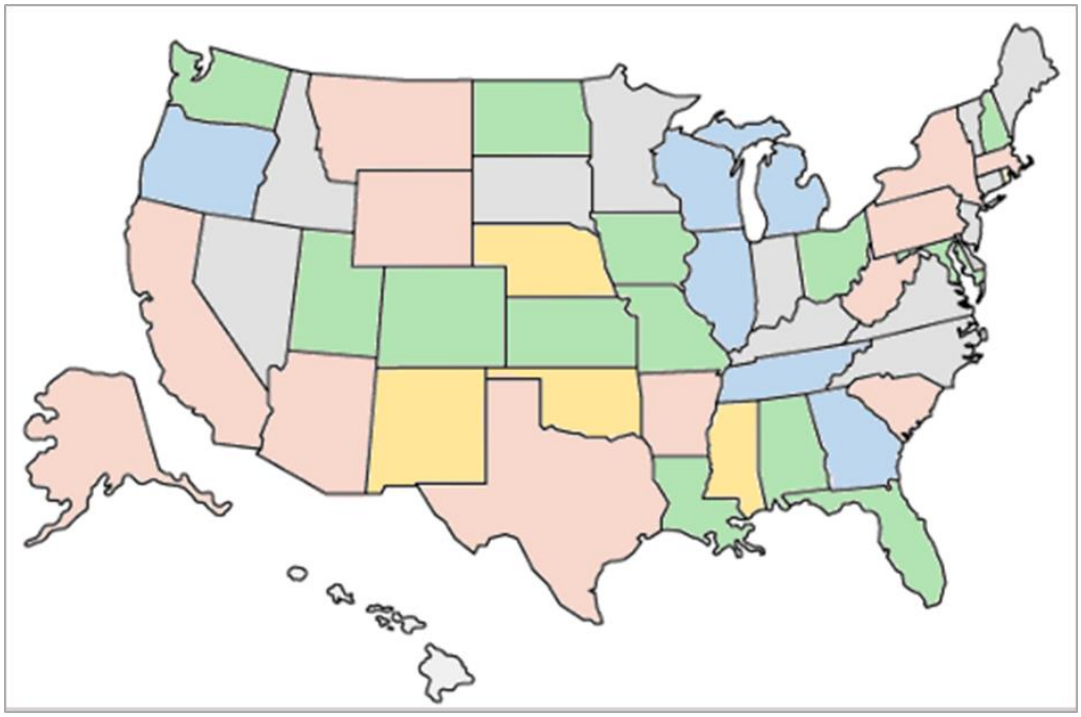


Figure 6.14 State Star Rank Color Codes

In visualizing the state map in figure 6.14 with the color coded system for communicating the star-ranking for each state, one can see that several of the states that border Canada and Mexico or have major ports of entry into the US are also states with only one star ranking for information about cattle traceability. Texas and Wyoming are both border states with a significant amount of economic income from beef cattle production. The fact that these and other border states score so low means that the producers and other potential state users and stakeholders are at a diminished capacity for gaining access to important information about traceability and identification. The map illuminates potential vulnerable pathways for disease transmission. States in the south eastern US particularly Kentucky, Tennessee, Virginia, and North Carolina border on multiple states with one star rankings. Idaho and Utah in the west are in a similar situation.

While a disease outbreak could happen anywhere, one would imagine that states with better information accessibility will be better equipped at understanding and dealing with risks and issues as they arise. In many cases these states colored pink are not communicating a perceived importance of the issue, or they do not have the organizational capacity within their web infrastructure to get the content that they do have out to the users through a simple Internet search. It is interesting to note also that states that are more centrally located tend to have a higher star rank. One would imagine that this is partially a factor of the amount of transport into the state from

other areas, though there are higher ranking states elsewhere such as Florida and Louisiana in the South and Washington in the North West.

In this chapter the use of the tiered system allows the researcher to visually compare heterogeneous variables with the content accessible and to rank the states according to their level of compatibility with the producer demographics of that state. This knowledge is combined with that of chapter 5, which reported a view of the current landscape of available content on cattle traceability and identification from each states' Department of Agriculture and Extension websites. In chapter 7, the researcher will address the results shown through the network analysis visualizations constructed in phase two of the research design to see the network of external resources and levels of connection throughout the nation. Then chapter 8 will report the overall performance of the states as providers of information and resources on cattle traceability leading to a discussion of the implications of this research for multiple types of information professionals.

CHAPTER 7 – GAP ANALYSIS: RQ 3 RESULTS

The previous chapters 5 and 6 reported the results for the first two research questions. The results of the content analysis reported in chapter 5 help to determine the landscape of the content from the two state websites across all 50 states by looking at the topics addressed, information types, information formats, and measures of information quality, interactivity, and relevance. Chapter 6 examined the context of the beef cattle industry in each state looking at demographic factors and comparing their relationship to the qualities found in the retrieved content through the use of a tiered ranking system. Now in chapter 7 the researcher reports on the results of the second phase of collection and analysis, which uses network analysis to address the third research question. Chapter 8 will follow with the results of the fourth research question summarizing the performance of the states over all the measures.

Research Question 3:

Where are the gaps, strengths, and weaknesses in accessible identification and traceability information communication channels between the federal government, external state, national, and international resources and each state's beef cattle producers?

The research previously addressed the gaps in accessibility to resources directly from the web resources, but the research also needs to look at another aspect of accessibility and equity; which is, where do the websites send their users to get further information? Are they sharing resources between websites and between states? Answering these questions is important because it allows administrators and officials to understand the way that information flows to and from the state through these

connections. The more connected the states are and the more they share relevant resources, the more equitable these outlets will be in transmitting needed information in the cases of disease outbreak or agroterrorist threat. Additionally, seeing the resources to which the states are currently linking gives those evaluating the states a clearer picture of the focus of that state. The choice of an external resource on a webpage is often an affiliation or trusted source and that source authority is communicated to state users of the website. The following visualizations provide a picture of this current network map.

Mapping How State Websites Connect to Resources

For the network analysis process the researcher uses the open source software Gephi to create models of the relevant external links collected from the resources retrieved from each state website. Each state website has a node and each link URL will have a node. The network is "directed" because the researcher is only looking at the connections from the state resources to the external resources. The network is presented using a layout called Force Atlas. As explained in the methods in chapter 4 this network format allows for the most effective visuals and the choice is not indicative of the need to use a specific algorithm to characterize the shape of the network. Here the emphasis is on visibility. The researcher repositioned the nodes further to best illustrate the connections and the node labels.

Two different network color representations will appear in the following passages. The first color designations will represent the type or role of the entity. The

researcher labeled the nodes by these designations and a color is assigned to each one. The nodes for this visual are shown in figure 7.1. Note that the light green and orange nodes are representative of the state websites. These are the nodes from which all connections originate, therefore it is possible that these other entities may link externally among one another and perhaps back to the state websites. This exploration would go beyond the scope of the research design.

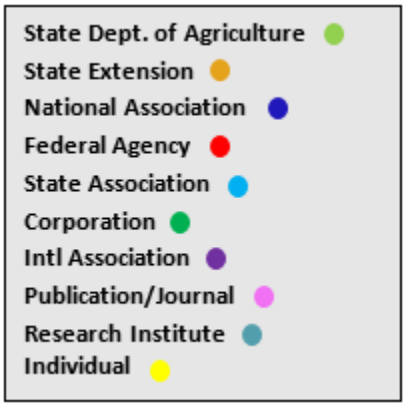


Figure 7.1 Node Color Key: Entity Roles

The second network color representations show the out-degree of the state links. The number of external links for each website is designated by the specific node color. For example, Vermont Extension has twelve links and is represented with a purple color. The color designations are shown in figure 7.2. These color keys will show up on the side of the network visuals to aid in full legibility of each view of the network. In all of the visuals the edges or connections are directed (the arrows point from source node to target node) to show the characteristics of the connection from the state resources

Figure 7.2 Node Color Key: Out-Degree Value

outward. Additionally the size of the nodes consistently reflects the degree of resources that link to it. This is referred to as the in-degree of the node.

Visualizing Existing Connections from State Websites to Other Resources

This first visualization, figure 7.3, shows the landscape of the information resources as gathered from the data collection process for all 50 states. From looking at the node connections and the hubs created, one can see that there is a definitive center of information. There is a large hub created in the lower portion of the image that shows the way that the resources are associated with one another. The red nodes are federal agency webpages and the largest node is the APHIS webpage that discusses the Animal Disease Traceability (ADT) final ruling information. The smaller hubs that are disconnected from the larger network show that not all the state websites are hooked in to this large network and the majority of the federal content. Many of the state websites do not have relevant external links, which can be seen in the single floating nodes of green and orange. The little clusters are instances where states link out to resources in which other states do not link. From looking at these we may be able to gain insight into the interests of the state and the perceptions of the important resources.

One might also suggest that the isolated states have a greater focus on the power of state run governance as opposed to federal governance; however, more exploration will be needed to understand the actual validity of such a suggestion. These states do however represent a significant disconnect in the channels with which

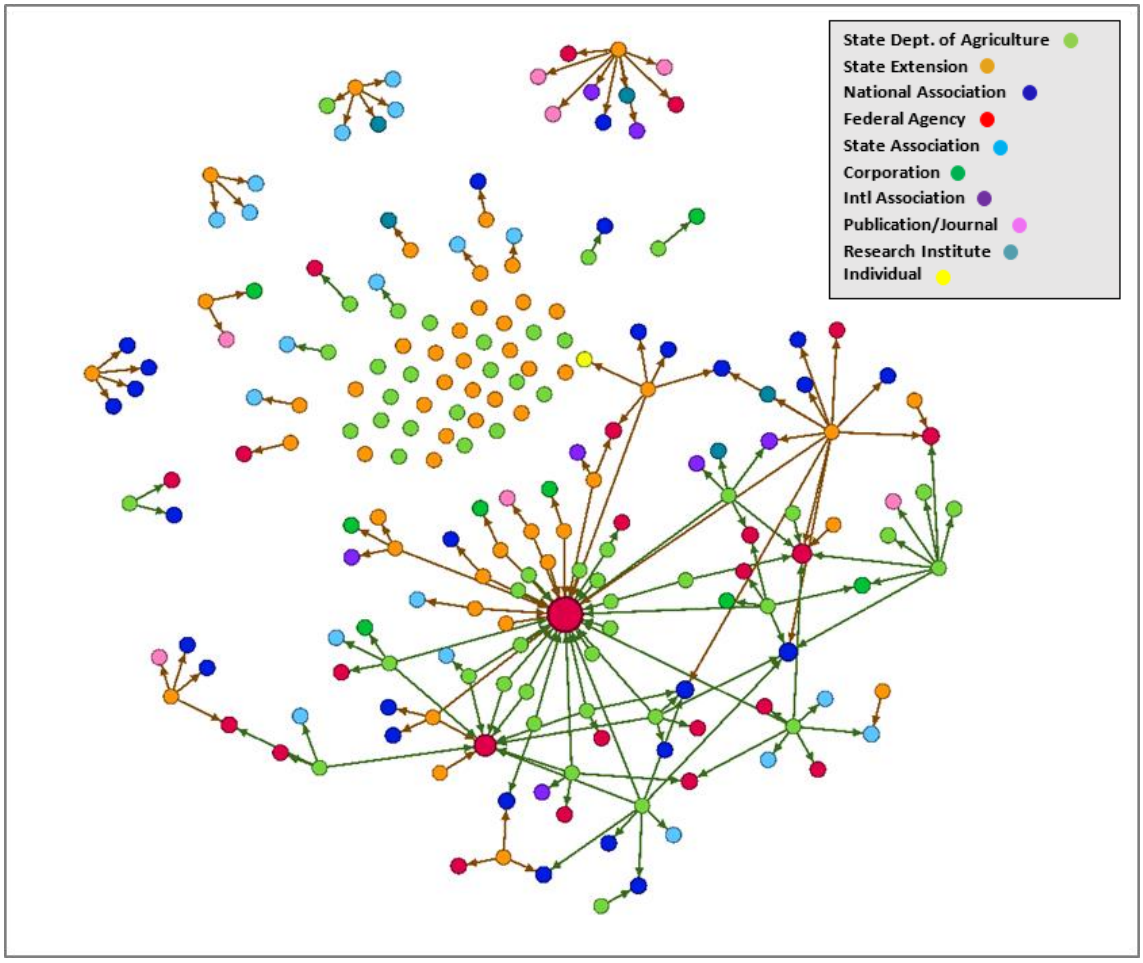


Figure 7.3 Directed Network Overview of State Nodes and External Links

information can pass from federal to state entities. State information managers may have avenues to communicating with state producers, but in the event of an outbreak or emergency are these channels set up to relay protocols and procedures from federal administrators? Would these state producers necessarily know where to go to look for this information?

The detailed views of this network that follow give greater insight into what states are connecting where and the most frequently linked resources. Also one can see the types of resources that the states use and deem important to share on the website. Figure 7.4 shows the relationships in the largest group of connected nodes in the network. The most cited URL is the APHIS Animal Disease Traceability (ADT) page, but among the other heavily referenced APHIS pages are the import/export page, the home page, and another page related to animal disease information. It is important to note that often if a state website links to one APHIS federal government resource, they often link to another resource as well, either government or another resource type. These results make sense because APHIS is the agency that released the final ruling and is responsible for the oversight of the information related to animal health. Generally attention to one of these resources by a state resource means that administrators are aware and feel the need to supply their audience with other relevant information that is available.

Figure 7.5 shows the previously mentioned largest federal node, the APHIS ADT webpage. This is also the most linked to node in the network and the visual gives a

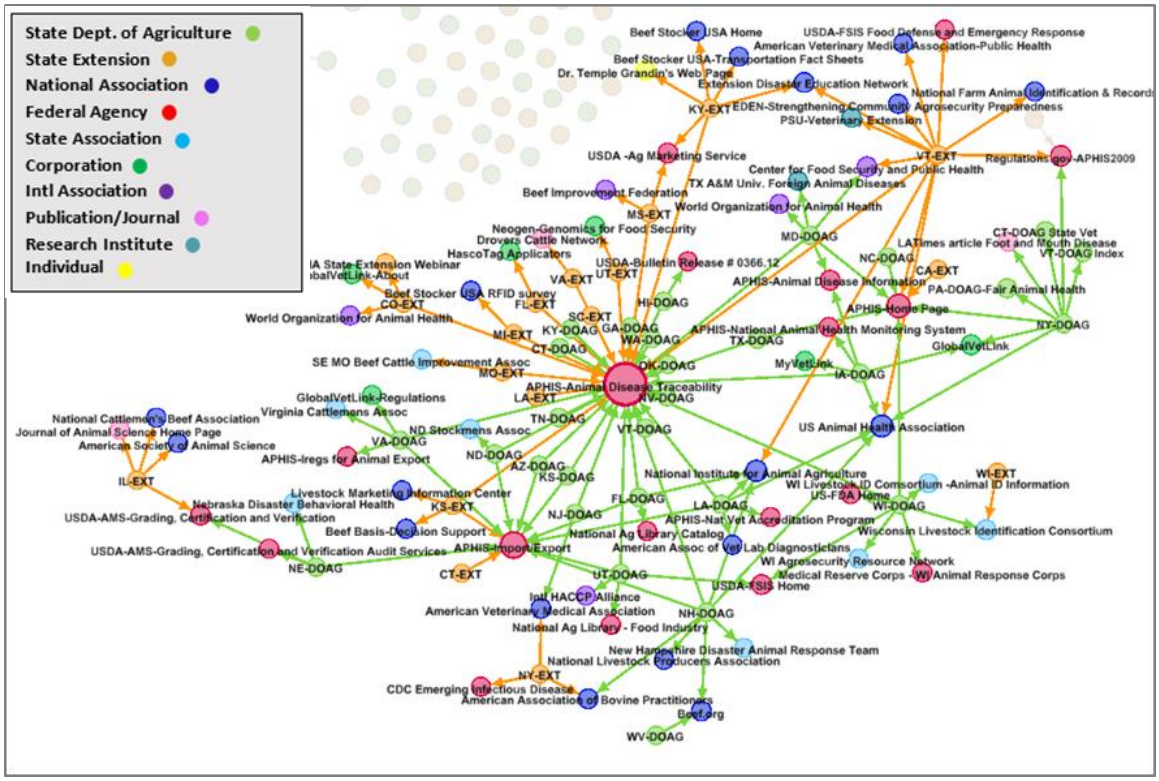


Figure 7.4 Labeled View of the Largest Hub of Connected Nodes

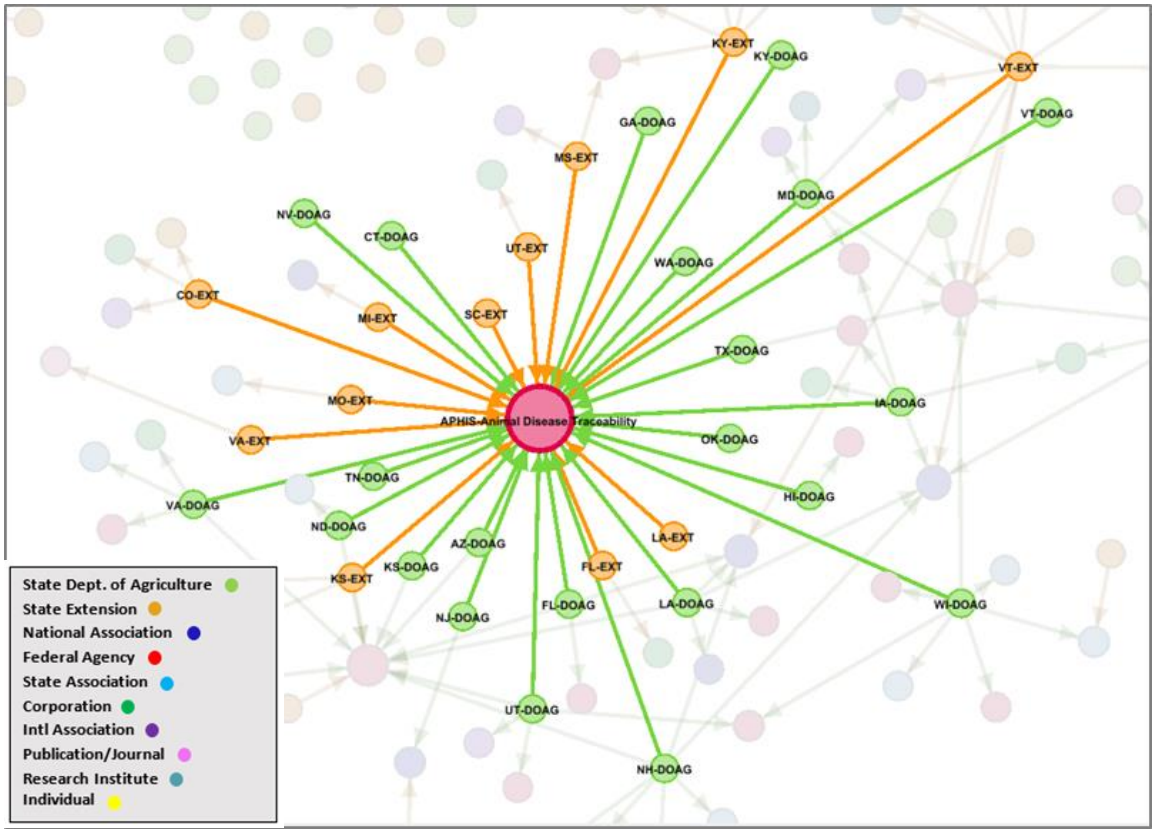


Figure 7.5 APHIS Animal Disease Traceability Node with State Website Connections

detailed look at the state websites that link to it. There are some states where both the Extension and the Department of Agriculture provide a link within the retrieved resources. Vermont, Kansas, Kentucky, Florida, Utah, and Virginia are all dually linked states. These states may have a higher focus on insuring they are connecting their producers with federal information. It is interesting to note that some of these states: Kansas, Florida, and Utah all scored in the highest rank for overall information accessibility and none of these states is ranked lower than three stars.

States where neither website's materials (from those results retrievable through the search process) link to this page include: Alaska, Alabama, Arkansas, California, Delaware, Indiana, Massachusetts, Maine, Minnesota, Montana, New Mexico, North Carolina, Nebraska, New York, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, and Wyoming. This is certainly a large number of states who do not provide easy access to this central resource about the current federal ruling. This may be problematic in the instance that changes are made to the rulings and if producers of that state need to be aware of new guidelines and regulations in a swift manner such as in the event of an emergency. Further inquiry is needed here to determine whether the producers are more apt to turn straight to federal resources or whether they would first look to the state where they are located and/or traveling within.

The following figure 7.6 shows a close up of the smaller hubs where state websites remain more closed as an entity sharing a couple resources that are unique to them. In the case of Rhode Island's Department of Agriculture is a government resource

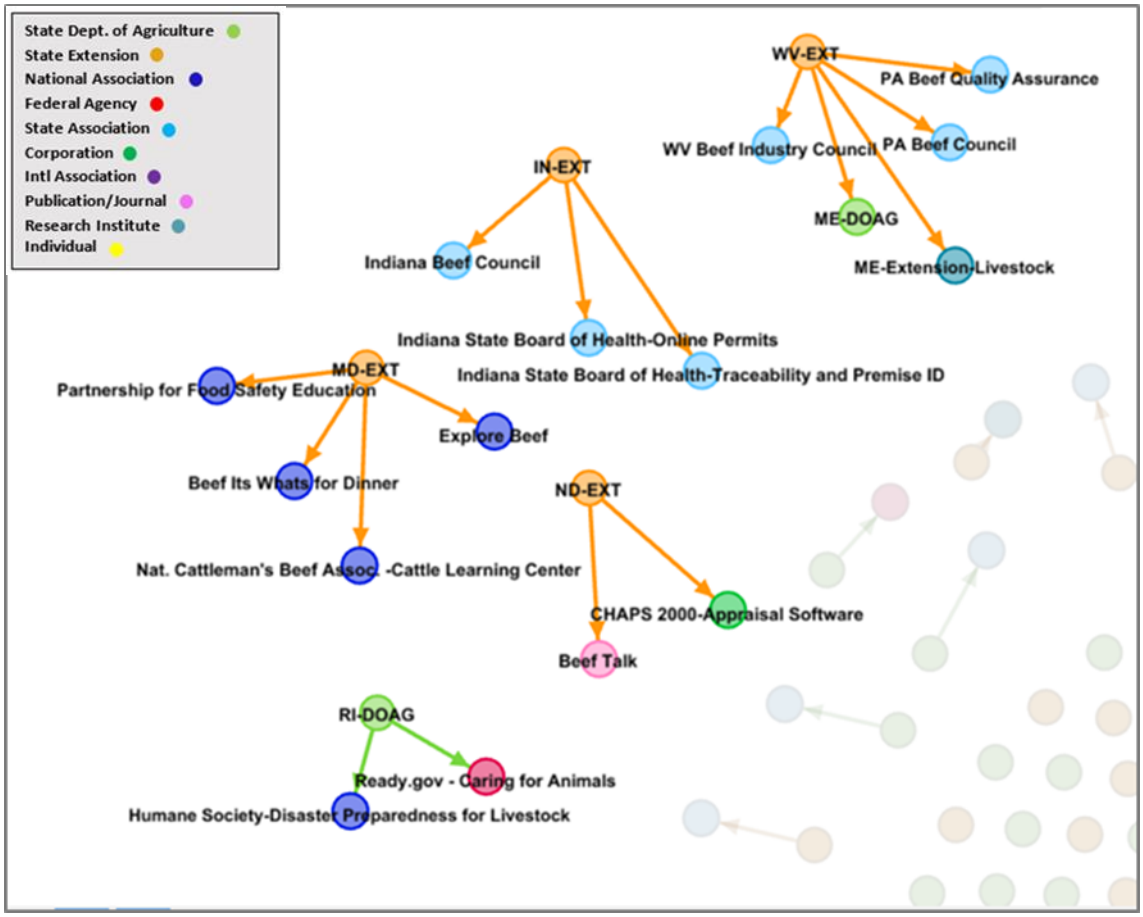


Figure 7.6 Smaller, Disconnected State Hubs

looking specifically at emergency care. What this suggests is that there are other resources that might be important for producers to know about that certain states have chosen to share with their producers. There must be some rationale behind these choices and not others. Indiana Extension in contrast, has connections solely to links that are Indiana based state associations. This may be an indication of an inclination to focus on state based regulations and activities, but it also may be the case that the state has a lot of resources and research that take precedence over the general federal rulings and perhaps communicate a great deal of information on their own. Maryland Extension links primarily to national associations that promote beef and education about beef and North Dakota Extension shares one publication website and one commercial application for decision support.

These resources communicate a focus for Maryland on consumer confidence in the beef industry and with North Dakota, perhaps a focus on commercial pursuits for the producers of the state. West Virginia Extension is unique in that the resources to which the website materials link are mostly resources from other states, including the Maine Department of Agriculture site. This is interesting to note given that West Virginia's Department of Agriculture is the one state resource that does not have a search capability on the website. While linking out to these other state's resources may be indicative of an underlying culture of sharing resources between states in the region, it may also be that the state is aware of the need to provide producers and other parties

with greater content than what the website and the entity itself is able to provide at the moment.

Figure 7.7 shows the nodes that have one or zero relevant or working external links available from the resources retrieved in the initial searches for information. While the idea of having no relevant external links may not be inherently bad considering that the resource may have exceptional internal resources and communicate all the need-to-know information to their state producers and other interested stakeholders, it still means that they are closed off from providing those users with the efficacy to seek greater information and to recommend external sources beyond the content they provide. In many cases, these websites cannot provide exceptional quality when it comes to covering a wide range of content or current information in the instance of an emergency such as an outbreak. This is where not having resources available becomes an issue of equity for producers if one considers that an individual will be going to the state sources for regulatory and other basic information.

There are some instances below where neither state web resources have any external relevant links. This is the case for Alabama, Delaware, Massachusetts, and New Mexico. The lack of resources makes some sense for a state such as Delaware or Massachusetts that has much smaller beef cattle production levels; however, states such as Alabama with a more average size production level may have another rationale. In Alabama there seems to be greater focus on communication that the ADT regulations they are implementing are state legislation of a traceability program that adheres to the

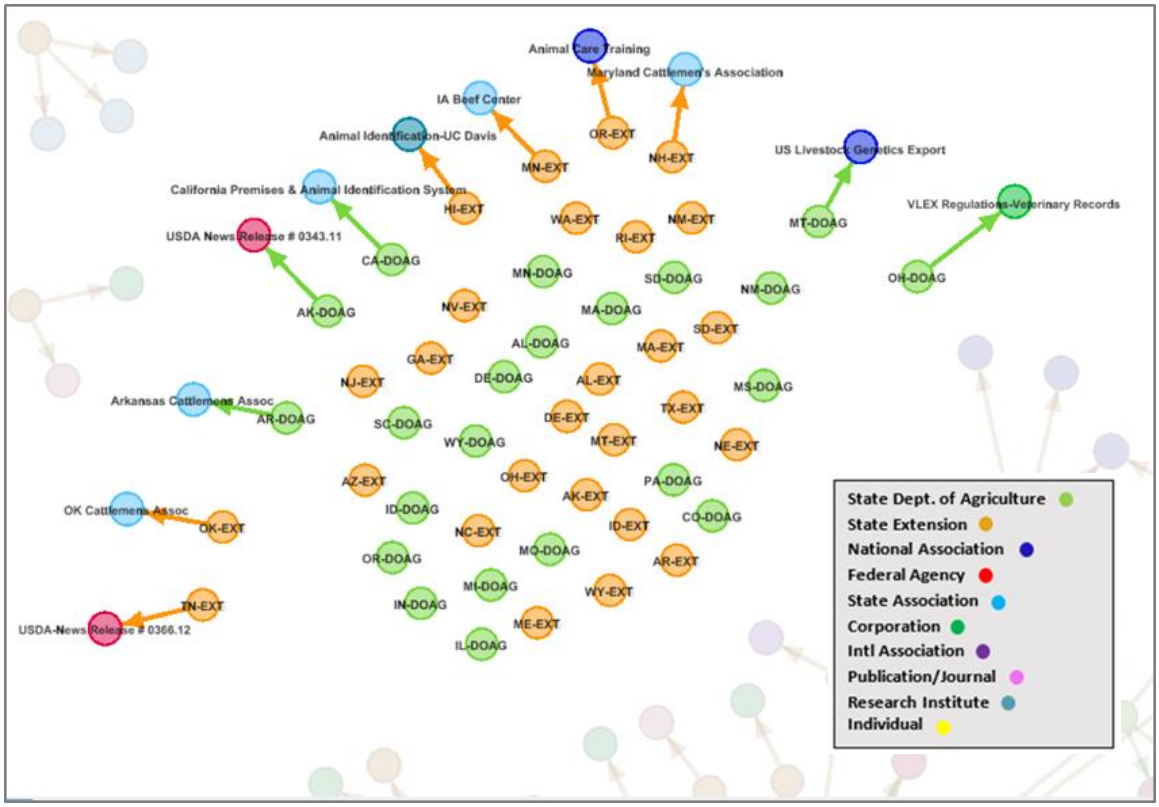


Figure 7.7 State Websites with One or Zero Relevant External Links

federal requirements. The ruling then comes directly from the state and there is less perceived need to connect at the national or international level to other resources. It is interesting that New Mexico does not link to federal, national, or international resources. This lack of connection may be detrimental given the state's position on the border of the country. There is potentially a lot of cattle traveling through the state from Mexico and Central America.

It is common that the singularly connected states below connect to a state association and in some cases this is the state's cattlemen's association, or an identification system. It is interesting to note that Minnesota's Extension connects to the Iowa Beef Center. This could be due to a large amount of collaboration between the two states given both their positions as higher feedlot focused states with a larger amount of state income from beef overall.

The following figure 7.8 shows the states that connect to the APHIS import/export federal government node. This webpage is especially helpful given that the majority of the mandatory federal regulation is based on the transportation of cattle into and out of states. The majority of the state websites that link here are Department of Agriculture websites which makes sense given an understanding that the organizational attention of the State Department is focused primarily on oversight of any regulations and the role Extension is more concerned with connecting the producers with practical and educational information, research developments, and

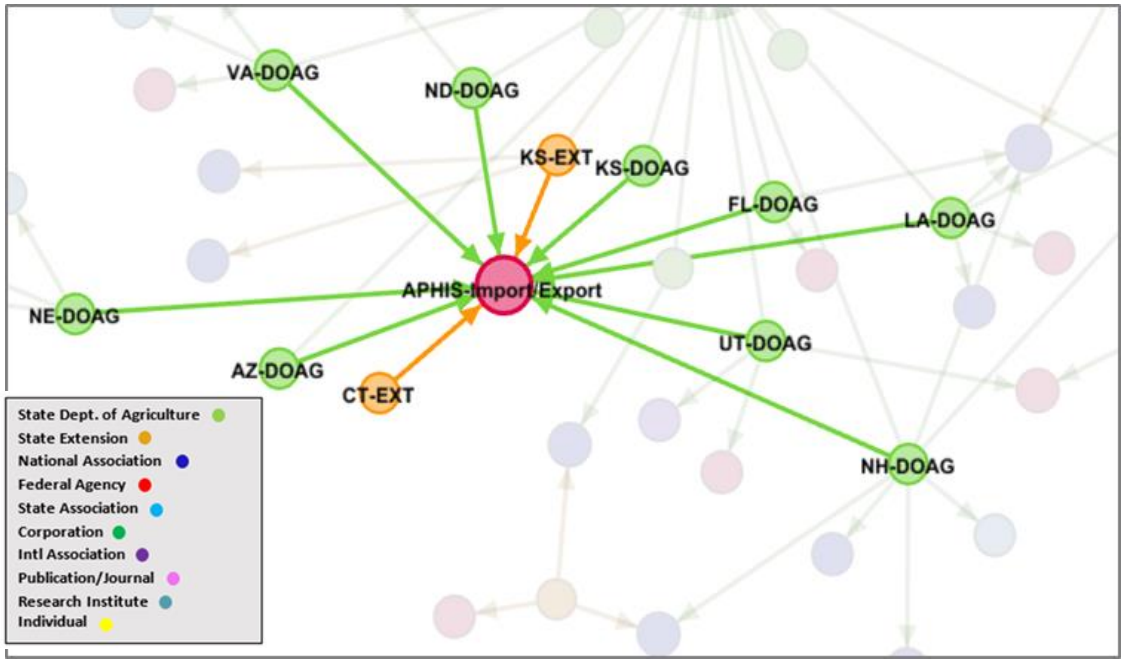


Figure 7.8 APHIS Import/Export Node with State Website Connections

programs of all types. Note that Kansas is linked by both the Extension and the Department of Agriculture websites. This is consistent with the state's high scores in many other areas of the analysis. It is interesting that only eleven percent of all the websites link here given the page's saliency within the current regulations. This could be problematic considering the importance of this information to safeguarding against the spread of the disease and the mandatory nature of this regulation. This also brings up the issue that users may struggle to find import/export information that is state specific when the landscape of available information from the sites is so diverse. It may be in one place in one state, and another neighboring state may be organized in a very different way.

Visualizing the Network by Out-Degree of State Website Connections

The previous views looked at the characteristics of the connected nodes, specifically the role or type of the entities involved. The other designation that is important to consider is the out-degree or amount of relevant external links from each website. The external links are important to note because they show just how outward facing the organization is and, on a bigger scale, how the state is in sharing information with their users. Do the state websites present the user with other outlets that they have vetted? The following visuals address the variations in out-degree within the network.

Figure 7.9 shows the same network connections as the earlier group, but the colors reflect the out-degree of each node. The nodes in red have none while the links in

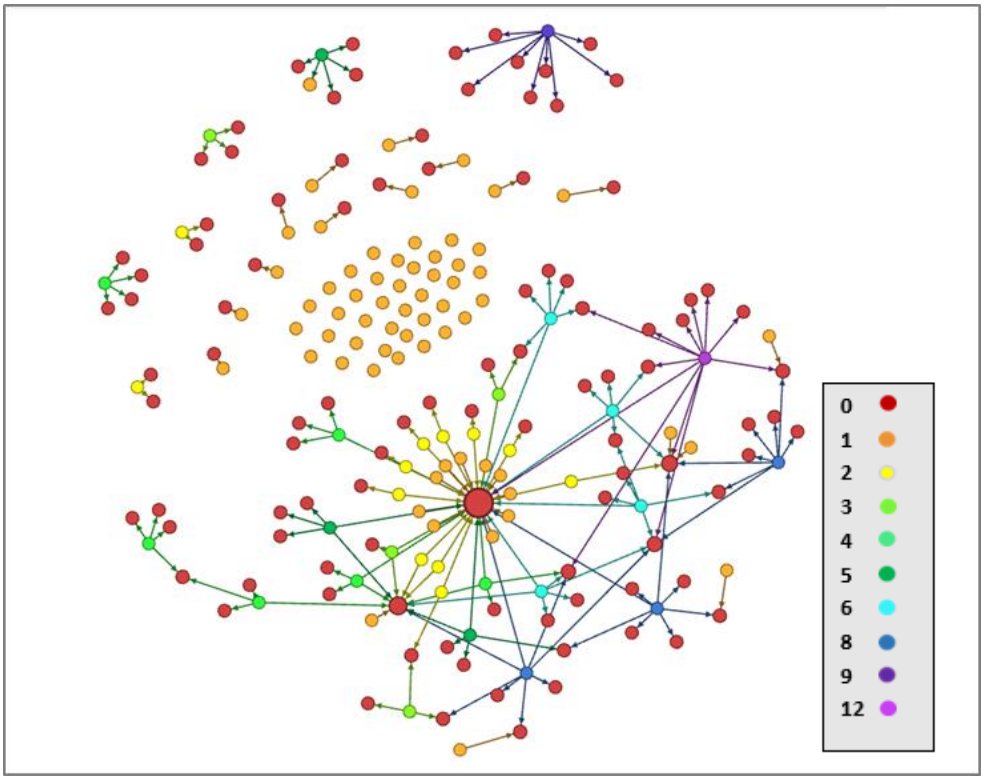


Figure 7.9 Directed Network Overview Showing Out-Degree of State Nodes

purple and magenta have the most. The single state nodes score as one because they are source nodes. The red color denotes only target nodes. The website with the greatest out-degree is Vermont Extension followed by New York Department of Agriculture, Wisconsin Department of Agriculture, and New Hampshire Department of Agriculture. It is unclear whether quantity of links is necessarily correlated with the quality of these resources; however, it is indicative of the state agency's sharing of information resources beyond the internal content. It also provides an avenue with which producers can continue their search that come vetted by the information professionals or experts representing that entity.

Figure 7.10 depicts the same network connections to the APHIS ADT webpage node as seen in figure 7.5, but now the colors depict the variation in out-degrees among the websites that link to the node. The majority of the state websites have two links, the main APHIS website and one other entity. This is shown with the yellow nodes. When one views this visual in conjunction with the previous figure 7.9, it becomes apparent that the majority of the states with the larger out-degrees are connecting with this website specifically.

Figures 7.11 and 7.12 show the two most connected websites, as previously mentioned these are Vermont's Extension website and Iowa's Extension website respectively. The resources linked to from Vermont's website include multiple federal government resources as well as other state Extension resources and national

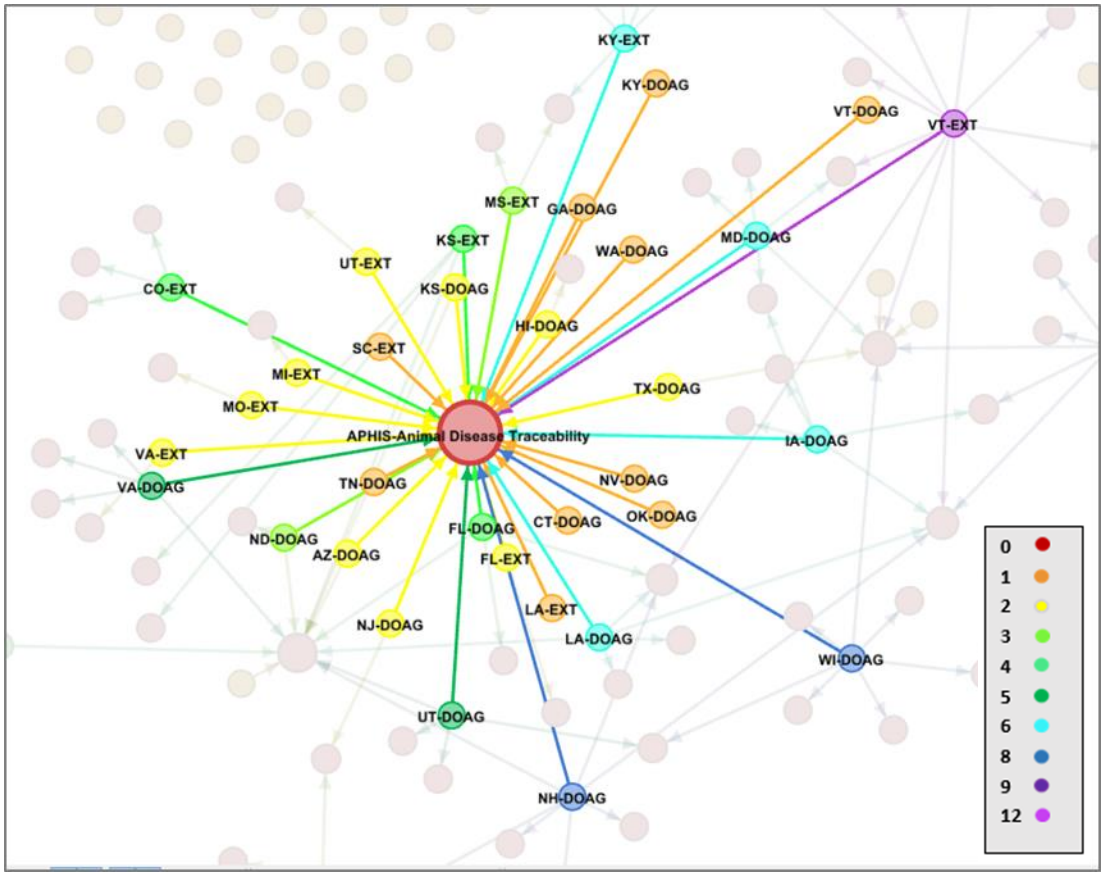


Figure 7.10 APHIS Animal Disease Traceability Node with Connected States Showing Variation in Out-Degree

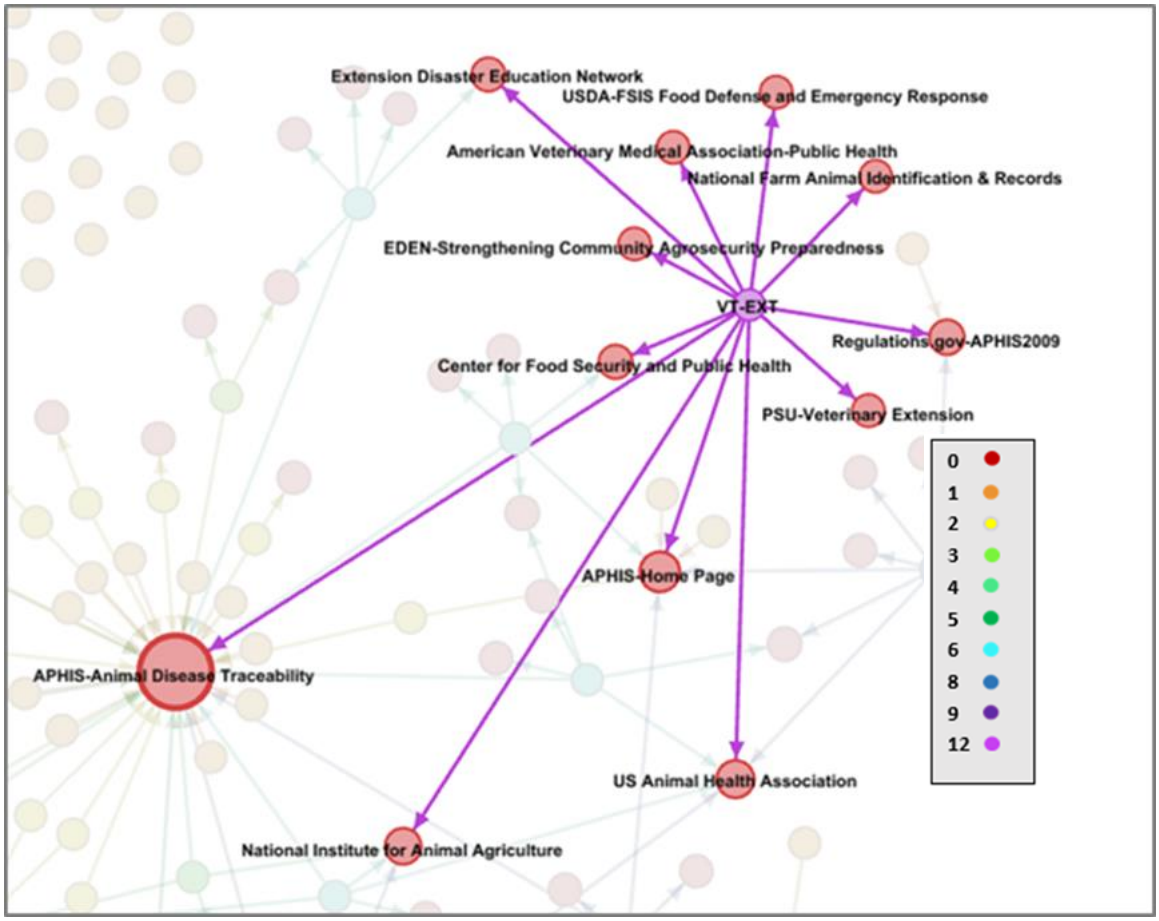


Figure 7.11 Vermont's Extension Website has the Most External Links.

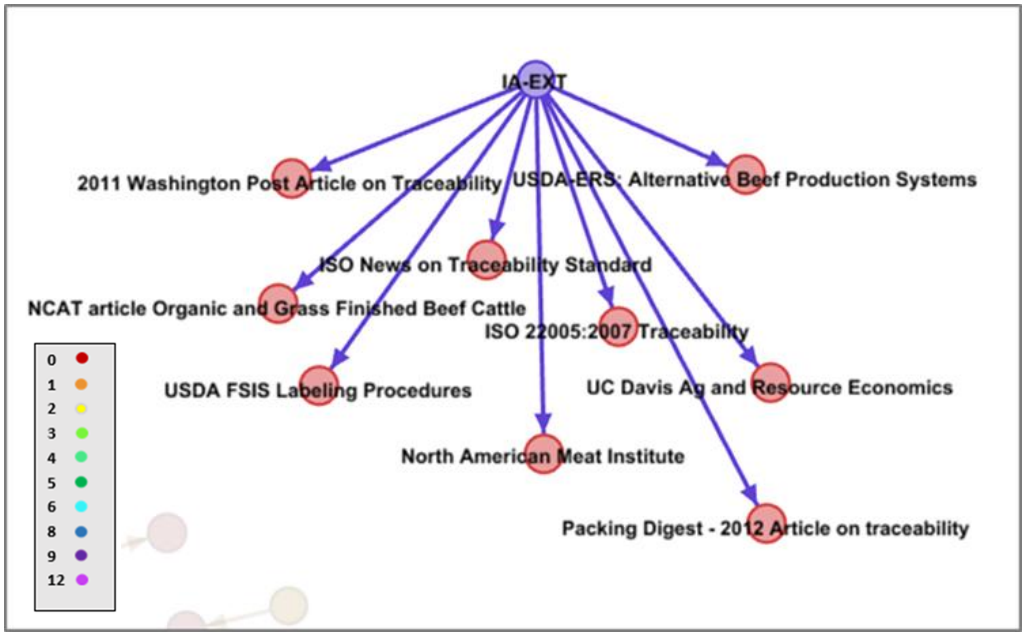


Figure 7.12 Iowa's State Extension Website Has the Second Greatest Out-Degree Yet Remains Unconnected to the Larger Network of Nodes.

associations. It is interesting to note that there are no Vermont state association links, commercial resources, or international association links. It makes sense that Vermont being a smaller state with significantly less cattle production than Kansas or Texas would be more likely to link outward to national associations and federal resources simply because there are less internal resources available, less other state associations devoted to this, and a smaller body of interested individuals. The fact that they do provide these links suggests an attention to vetting resources that are considered good outlets for producers and other users in the state.

Iowa is different than Vermont in that its nine links are not linked to by any other states and it remains much more isolated in the overall network. Looking at these isolated resources however, one can find some very specific resources that may be important for other states to include. In this instance Iowa is the only state that includes a connection to the ISO traceability standard. The choice to include this resource potentially reflects the user groups accessing information in Iowa. This relates to Iowa's status as having a higher income from beef cattle operations and more operations in the higher income classifications. Producers may desire more information about advanced technological specifications because there is more funding able to be allocated to these tools and potentially more research into traceability practices in the state. Being able to see these resources in relationship to the entire network is the only way that officials and administrators can get a comprehensive view of what everyone else is recommending and connecting with.

Assessing the network of external links from the two state websites adds a layer to the content unobservable in the previous chapters. Here one can see that there are many states that are isolated from a larger network where the states are sharing information available on similar sources. Website administrators and content developers will be able to use this process and the images generated as a tool to see which states link to which resources. States with similar producer profiles may want to consider the links of the other for their own material. Additionally, one can see that without any central community access point there is no standard link to federal resources. This may be something that state and federal officials consider in the effort to safeguard the country's beef cattle and to mitigate the spread of a disease in the instance that there is an attack.

This chapter discussed the results for phase two of the research design, which answers the third research question regarding an analysis of the gaps in the resources' connections to an external information network. This builds upon the previous findings from chapters 5 and 6 which reported the results to answer questions one and two about the availability of information and about the equity of access to the state resources respectively. In the following chapter 8, the researcher will discuss the results from the final research question about the overall performance of the states across the nation.

CHAPTER 8 – OVERALL PERFORMANCE: RQ 4 RESULTS

In previous chapters 5, 6, and 7, research questions one, two, and three each deal with different aspects of access to information from the state websites. In this final question the researcher looks at the overall landscape of these results to summarize the different areas where certain states are most successful. It is important that the research acknowledge these states as leaders in these areas as the web channels may be resources for other states that have a similar demographic profile. Even if the states are quite different than those high performing states, other states may still be able to adjust the concepts and items of merit to fit with their own user demographic. By seeing the differences in the levels of performance, all state web content administrators and information professionals are able to see where they stand in relationship to the other states and to assess potential national vulnerabilities and future points of collaboration. Seeing these gaps is the first step to overcoming these vulnerabilities and strengthening the cattle industry in the US as a cohesive informed network.

Research Question 4

Out of all 50 states, which states have the highest level of overall performance in providing equitable access to resources on cattle traceability for the producers and other stakeholders of the state?

In chapter 5, the content analysis results provide a glimpse at the independent performance components of the states. The states are ranked according to the degrees with which they successfully demonstrate topic coverage, information quality, interactivity, and relevance. The top ranked states include: Washington, Utah, Ohio,

Maryland, North Dakota, Florida, Alabama, Louisiana, New Hampshire, and Colorado (in order from the top.) The three states at the bottom ranks include: West Virginia, Montana, and Wyoming. For the full display of the states' independent ranks please see chapter 5, table 5.5.

Chapter 6 introduces the concept of the tier system to compare contextual state demographic factors that are important in defining how effective the resources are at fulfilling the needs of the producer population. After scoring for each context-based hypothesis statement the researcher ranked states according to their overall context-based effectiveness and combined this rank with the independent rank to get a combined ranking for each state. The full explanation of this process is shown in tables 6.28 and 6.29. The top ranking states for the contextual components include: Iowa, Florida, Kansas, Missouri, Oregon, Washington, Colorado, Minnesota, Alabama, Michigan, and Wisconsin (in order from the top). The three lowest states for the contextual components include: Rhode Island, South Carolina, and Vermont. Figures 6.13 and 6.14 show the star-ranking for each state overall. The five-star states are: Washington, Florida, Utah, North Dakota, Alabama, Ohio, Maryland, Colorado, Louisiana, Iowa, Kansas, New Hampshire, and Missouri. The lowest ranked, one-star states are: South Carolina, Montana, and Wyoming. The states with these lower starred ranks will want to look to the components of these five-star states in taking efforts to provide more effective information resources.

Finally, the research brings in the element of the network analysis to complete the discussion of the overall performance. The most apparent findings when looking at the network are the central federal entities that a majority of the state nodes are connected with. As the discussion of the results notes, several states are connected to the central node (the APHIS Animal Disease Traceability webpage) by both the Department of Agriculture and the state Extension website resources. These states include: Florida, Kansas, Kentucky, Utah, Vermont, and Virginia. On the opposite end of the perspective there are several states where neither website entity node links to this central page. These states include: Alaska, Alabama, Arkansas, California, Delaware, Indiana, Massachusetts, Maine, Minnesota, Montana, New Mexico, North Carolina, Nebraska, New York, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, and Wyoming.

Another major part of this network is the APHIS Import/Export information webpage, which provides overarching federal information for producers transporting their cattle across state lines. Kansas is the one state that links to this node from both state websites. The other states that link here include: Arizona, Connecticut, Florida, Louisiana, Nebraska, New Hampshire, North Dakota, and Virginia. One should also take into account the states that have no relevant external links available from the retrieved resources. These are states where the website content managers will need to take stock of the best external resources to provide to their users. The states include: Alabama,

Delaware, Massachusetts, and New Mexico. Finally, the states with the most external links are Iowa and Vermont.

In combining these high performing states across all these parameters, one begins to see that some of these states come up multiple times. Table 8.1 shows all the top performers together for each item. One can see that Florida and Kansas appear most often across the different ranks; Florida with five appearances and Kansas with four respectively.

Table 8.1 Overall Top Performing States in Each of the Research Areas

Independent	Contextual	5-Stars	Both Nodes Connect with APHIS ADT	Connects with APHIS Import/Export	Highest Out-Degree of Relevant Resources
WA	IA	WA	FL	KS	VT
UT	FL	FL	KS	AZ	IA
OH	KS	UT	KY	CT	
MD	MO	ND	UT	FL	
ND	OR	AL	VT	LA	
FL	WA	OH	VA	NE	
AL	CO	MD		NH	
LA	MN	CO		ND	
NH	AL	LA		VA	
CO	MI	IA			
	WI	KS			
		NH			
		MO			

It is recommended that states that are listed in the lower tiers throughout the research look to these states for insight and ideas. Additionally, these states will also have resources that may be quality additions to supplement website content. While the top two states are exemplars, each state should assess their demographic profile and look to higher scoring states with a similar demographic profile, to gain perspective on

ways to improve the equitable accessibility of information. Additionally, states with specific deficiencies in one or two areas can look to other states that rank higher in that one area.

The previous three chapters along with the current chapter 8 report the results of phase one and two of the research design in an effort to answer the four research questions. In the following chapter 9 the researcher will engage in a discussion of the issues noted in the results from these two phases expanding upon the answers to the research and discussing the implications of the body of results as well as offering specific use case scenarios and best practices for stakeholders and information professionals. Finally the concluding chapter will discuss some limitations of the research and give an overview of the potential for myriad types of future research that arise out of this initial, national-level, content and network analysis.

CHAPTER 9 - DISCUSSION

Chapters 5, 6, 7, and 8 of the text share the results for phase one and two of the analysis and answer the four research questions. Chapter 5 discusses the results for the first research question regarding the information resources accessible for each state. Chapter 6 addresses the results of research question two, which asks about the equity of accessibility in conjunction with the demographic, economic, and legislative diversity of the states. Chapter 7 reports on the results from both research questions three and four. It discusses where the gaps, strengths, and weaknesses are in channels of communication within the information resource network. Then chapter 8 reports which states have the highest overall performance level in providing equitable access to resources. In the current chapter 9 the researcher takes a deeper look at the findings and discusses the implications of the results for producers, other stakeholders, state and federal web administrators, and information professionals. Additionally this chapter offers a list of suggestions for the web administrators and information professionals and presents three use case scenarios to consider when applying this method in future inquiry.

The driving force behind this process of analysis is that equitable access to information is an important aspect to mitigating vulnerabilities in the security level of the nation's beef cattle industry. With this statement comes the pernicious problem of defining access in a heterogeneous society where multiple variables are integral in shaping an effective understanding of how to define and measure equitable access to

resources. Through careful review of the body of data collected the researcher found that asymmetries in the information provision exist from both the state department and state Extension web channels. As the analysis shows, a majority of the material is not thoroughly meeting the needs of producers in the state. The gaps in information provision and access that occur in multiple dimensions create vulnerabilities in the security of the nation's beef industry. Through the following seven issues shown in figure 9.1 including: the absence of the necessary materials, the low scores among the high producers, the issues of fear that drive omission, misdirected concerns, differences in focus for content delivery and regulation, the importance of interactivity, and the technological barriers to access, this dialogue expands and digs deeper into the implications of the results from the analysis. Suggestions and best practices arise from these factors that allow for future work to bridge these gaps and mitigate vulnerabilities.

Absence of Necessary Materials

First, one of the most important issues to note is that many resources are not available from the websites that need to be. The absence of certain elements are impediments to producer and stakeholder knowledge about the issues of traceability and identification. In previous studies discussed in the literature review, researchers and experts note that there are producers throughout the country who when surveyed knew little about identification and in some cases did not practice any formal identification or traceability methods (McBride & Matthews, 2011). This lack of knowledge resonates

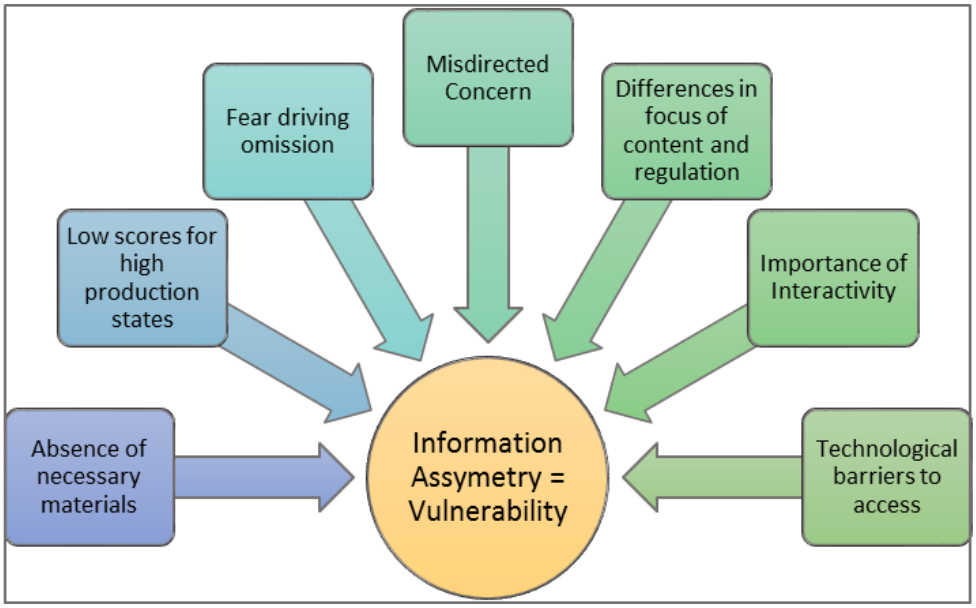


Figure 9.1 Elements of Information Asymmetry Fueling Vulnerability

with the research finding that overall there is a lack of basic information from the two websites. It may be that content administrators are under the assumption that this information is gained elsewhere, perhaps in informal networks of communication with peers. It is a practical concern that every producer understand the process of traceability and know how to apply it within their practice. One wonders if there are other online resources available with more information, such as the state beef board and/or a cattleman's society for the state or region; however, there is little standard acknowledgement that these other resources exist consistently nationwide.

Farmers and ranchers with lower experience levels, who may be younger, and may or may not fit in with the more informal communication networks may struggle when looking for basic information about traceability and identification. This struggle becomes a barrier to proper compliance for producers in this position. In particular, a state with a high level of cow-calf operations should have more basic information than the results indicate. One speculates that since operators may not have been subject to requirement in the past and may not necessarily be subject under the current ruling, they will not see the possible return on investment from traceability measures especially if there is little basic information on the system as a whole. Providing that overview illuminates the entire process and will help to dispel multiple skepticisms based on fear and misunderstanding.

The subject of instructions and how-tos is similar to the topic of basic information. Having instructions available facilitates compliance with new regulations

especially for those individuals who do not have time to attend workshops or find access to instructions and in general for those producers in more remote locations. More basic coverage of the process means that individuals can pinpoint areas where they need assistance and they can feel more prepared to begin asking questions and making requests. One component of instruction is the need for more visual cues and greater focus on visual resources that provide a multi-faceted look at processes. Such a focus takes into consideration issues that people have with legibility, learning style, and those whose primary language is not English.

Busy producers and stakeholders who have an information need are going to be less likely to read a big hunk of text without visual cues to aid in rapid comprehension. Steve Krug speaks of this in his book on usability from 2000, *Don't Make Me Think*. He lists important concepts to remember in web design that are features in the human computer interaction experience. The first one he lists is that users revert to scanning pages rather than reading them. The number one reason for this is that users are generally purpose driven. "Mission-oriented" is a good way to characterize the producer as information seeker. The user will only see a part of what is actually there because she is moving quickly to find the key elements that identify the answer. Otherwise precious time is lost.

Another major absence within the category of regulatory and legislative information is discussion of the legal consequences of non-compliance. This is integral for individuals to have a clear understanding of the risks. Since the states may have

different requirements, clarity of the consequences is a standard element to motivate and sustain that motivation to comply and stay abreast of any changes to regulations. When legal consequences are not mentioned from these authoritative channels within a standard search for information, the absence communicates a lack of stringency. This is especially important given the dynamic nature of the regulatory process over the past decade and a half.

The changing nature of the regulations brings up another problematic area of absence. Of all the information quality standards in the analysis, the one where states are often deficient is currency. The defining nature of the issues is in part their relationship to biosecurity and the presence of swift legislative change. This means that in order to be effective, resources need to demonstrate higher levels of currency across all web content. Webpages do not often clearly indicate when content is updated. In states with a higher score for perceptions of regulatory stringency it is especially important to address and correct for a lower attention to currency. This absence can affect levels of institutional trust because it undermines a perception of authority that should be inherent from state web resources.

Finally, an area of absence diminishing the quality of the communication between important information resources are the missing links to federal legislative resources. Several state websites have no relevant external links and only eleven percent provide a live link to the livestock import/export information from APHIS. This is the central resource regarding federal regulations, yet no clear standard connection

exists between the federal and the state resources. Producers and stakeholders may also struggle to find important information from states about import/export since the landscape of the state websites' contents are so diverse. It is extremely difficult to retrieve relevant information all the time. Without a link to some consistent source for proper regulatory information about import/export producers do not have a consistent, sufficient network to access when planning transport activities.

A large number of the states also lack a connection to the federal information resource from APHIS that explains Animal Disease Traceability (the final ruling from 2012). This link is important for producers to be able to access from one or both state websites. In the event of an emergency such as a disease outbreak, the state based websites may not be able to update their content quickly. A federal link from a state resource allows producers and stakeholders a quick and easy venue to access the federal information through the state channel. The analysis shows that this feature is not yet available through a simple search in all states.

Low Scores from the Highest Producers

One might assume that states with the highest level of cattle production and income from cattle operations are naturally the states that score highest for providing information on their state websites because these are the states with a greater amount of information need; however, this is not often the case. Instead, states with reputations as major players in the beef cattle industry are often the states that score lower across the measures in the analysis. This discrepancy is a large part of the

suggestion that there is information asymmetry among the state resources. One especially problematic instance is low coverage of the information topic of guidelines and regulations in states such as Texas that have an extremely high level of small operations.

As pointed out in the demographic analysis of the states in chapter 6, the sheer size of Texas makes it difficult to assess with the other states. This notion characterizes the large amount of existing need that producers have for information and the consistently low scores in turn show that the state may be especially vulnerable to disease outbreaks. Wyoming is another state where this high level of incongruence between access to information and scope of operations occurs. Wyoming has the highest economic dependence on income from the beef industry as a percent of agricultural income and yet there is a huge disparity between the state's need and access since it is the lowest ranking state for the independent values in the analysis.

This disparity also extends to concerns about low scores in coverage of security and disease topics. Coverage of this subject is extremely salient given the position of many of these states on the border of other countries (as in the case of both Texas and Wyoming) and/or their position as a state in which many other states are importing cattle for feeding and slaughter. The lack of coverage in these particular states is concerning because they are so important in the supply chain. The most vulnerable of these are the red states (one-star ranked states) shown on the map in figure 6.14 that border Canada and Mexico.

States with high numbers of production and income often demonstrate little attention to interactivity and relevance. For interactivity, it may be that the information infrastructure is not designed to manage interactive applications and a social media presence when there is a large population of individuals that they serve, or perhaps there is a perception that this is not an effective channel for feedback and dialogue. One would imagine; however, that with the scope of the operations involved, more individuals would also be seeking out interactive ways to communicate via online channels. If so, allowing for this interaction will foster further communication and the professionals' ability to gather the perspectives of the community, which would then be integral in establishing the best possible resources for those who are using it most.

This addition goes hand in hand with the issue of relevance. The more interactive opportunities to hear the voices of the information seekers, the more administrators can do to rectify issues of relevance in the currently available resources. Part of the issue of relevance stems from the design and maintenance of the search engine and the contents available within. Currently there is little help retrieving information in the states that may be most vulnerable. Information seekers may struggle to find what they are looking for and give up with the perception that the information is not there.

When it comes to developing and maintaining a system, there are cultural aspects beyond the practical that will drive disparities in access unless the aspects are taken into account through research with the populations. These are issues viewed in the current analysis such as internet access and ability to use technology, but it also

involves considerations such as literacy levels, language nuances and trust of the entity involved to name a few. It is suggested of the states through the outcome of this research that they begin to think about the risk involved in continuing to disregard these disparities. The income-related and economic risks of remaining uninformed can serve as motivation to web administrators to safeguard financial futures of their state operations by providing information management efforts beyond the current low scoring levels.

Understanding Factors of Fear and Omission

In looking at the elements of content that are missing among the states and the levels of quality that are too low given the size of the industry and producer populations within the state, one wonders why things are the way they are. There may be perceived consequences and tacit fears that begin to explain some of the reasons why certain content is absent. By addressing some of these issues the researcher hopes to bring to light discussion for potential compromise and increased understanding of the risks versus the benefits of including certain information from these state sources.

One large omission is the topic of dispelling myths and misinformation. There are very few instances among the states when resources attempt to dissuade issues that circulate as producers and other stakeholders debate the pros and cons of traceability regulation at the state and federal level. Spending a few minutes on many of the beef cattle blogs and agricultural social networks will yield a generous and heated debate about the issues and their implications. Often debate expands beyond the actual

objective bounds of the issue in an effort to convince others of the importance of one side of the argument or the other. There may be a sense from web administrators, state officials, and other information professionals that addressing the current aspects of misinformation will alienate individuals and turn away information seekers in the future. More exploration is needed to determine if this is true; however, the state websites do present an advantage over other web resources in that they maintain a position as an authoritative voice in a sea of other unaffiliated voices with unclear motives.

It is important in issues of social complexity such as this, which garner a great deal of feedback on all sides, that websites exploit their position as an authoritative voice. This means taking the time to address credibility of information and to provide contrary evidence to rumors and myths that perpetuate among less formal communication networks. In one example, the Indiana Extension website displays a logo on some of its resources that state the document is “expert reviewed.” Subtle vetting of content is especially important for information seekers looking to find an accurate answer to a question.

An important issue to discuss in addressing potential fears is that there may not actually be clear definitions among content producers and web administrators of the rumors, myths, and misunderstandings that abound. This issue is related to the amount of interactivity from the web channels and whether or not there are opportunities for questions and for feedback to the source of the website as well as from it. Without this dialogue the information professional is only as knowledgeable as their own research

will take them and is limited to one's own lived experience of the issue. Whether it is through interactive media or qualitative research with producers, web content providers will be more successful with a greater understanding of the issues of contention among their audiences.

Additionally the analysis shows that the websites seldom address the issue of agroterrorism. The term itself is not often spoken, nor do many of the websites ever discuss the consequences of disease outbreaks. One might imagine that it would be essential to avoid this topic in order to ease potential consumer fears about the safety of beef and maintain consumer confidence in the beef industry. Administrators may also be hesitant of engaging in this type of discussion for fear that it might plant a seed among potentially malicious individuals and terrorist organizations. This resonates with Cupp et al.'s (2004) statement that the mere suggestion of a biosecurity issue can create immediate and extensive problems to industry performance. It is likely that information managers working in this area are concerned about raising anxiety among consumers.

The question remains about how to discuss the importance of emergency preparation and establish an idea of the motivation behind traceability and identification regulation without raising public unrest and the potential for detriment to the beef industry. Addressing issues of agroterrorism will potentially increase demands from the public about transparency. This has both good and bad aspects for the producers. Notably the increase of online information and public engagement with information on food security and traceability as well as transparency of source, good

agricultural practices (GAPS), and attention to organic, humanely raised, and hormone-free beef are already increasing demand from consumers for greater information. Web administrators will need to be more prepared in the near future to address these issues head on from a position of authority. They will have to make compromises between "safe" levels of information and complete transparency at the risk of scaring consumers away from purchasing beef.

Misdirected Concern

To further address the asymmetrical provision of information about traceability the researcher turns to the problem of misdirected concern. The critical concerns from the literature that looks at the perspectives of cattle farmers are often the very issues that are absent or lacking in coverage on the state websites. Liability, privacy, and costs of implementation are cited throughout the research as the three most common concerns of the producers about identification and traceability regulation (Anderson, 2010; Bailey, 2007; McBride & Matthews 2011; Schulz & Tonsor, 2010). Looking at the results, one can see that these topics are some of the least covered across the states. While it is not that these concerns are directly a function of the lack of coverage about the topics on the resources to which producers have access, these concerns are inherent fears that arise from the nature of being monitored through data collection and from a lack of control over additional costs to an already struggling business. For example, one may recall the upset raised by the general public upon hearing of monitoring of cell phone records by federal government agencies. These fears and

needs as expressed in the literature provide an opportunity for information resources from the state to communicate about the most salient problems to producers by addressing them head on. Leaving these concerns unaddressed communicates a tacit message to producers that the institution is not interested in their struggle. Additionally, providing information that misses these needs is not effective to either group and suggests to these producers and information seekers that the institutional focus is elsewhere.

States are providing a lot of information about the new guidelines, but without addressing the legal consequences. What incentive is there to comply? Both issues need to be clear to ensure a level of trust and understanding. This goes hand in hand with the concern of liability. What happens if my animals are not properly tagged? What is the least I need to do and pay to make sure I do not get in trouble? Answers to questions such as these could be presented as simple frequently asked questions pages. Personal financial sustainability is on every producer's mind and part of feeling in control of the situation is in having the ability to balance the costs to the business with the potential risk and potential gain from different programs and options. Information like this is available in some states, yet there is no clear resources that really compare the costs with the risks and the gains holistically. Addressing privacy is equally important. Underrepresentation serves to perpetuate distrust in the institution and the traceability efforts. When the state resources are able to provide a clear answer to the question, "who will know about my practices and who will manage and have access to my data?"

there will be less fear that the reason information is left out is because the individual would not like the answer.

Why is it exactly that the researcher suggests the concerns are misdirected? To some extent the content is available, but the depth is not. Instead what the analysis shows overall is more institutional communication. Often the websites display mission and vision statements and report about regulations in specific language of the institution. In contrast there is seldom discussion of substance that addresses the concerns that are identified in circles of practice and through surveys of the producers. This suggestion is supported by Boone et al.'s (2011) study in West Virginia, which found that the majority of the producers felt unprepared for the instance of an attack. The researchers recommended more easily accessible resources on the subject. If these resources do exist in the online environment, there needs to be greater effort in making them retrievable by an individual with very little experience using a search engine and with very simple search terms.

One way to break down barriers between the government and communities of practice or cultures of work is when that particular governing body can work to make the user community visible within those resources. Websites need to take a proactive approach instead of a reactive approach given the nature of the information as associated with risk and emergency action. By establishing these trusted channels that address the concerns of the producers and other users, it will be easier to relay information when it matters most. The existence of the current state of misdirected

concern provides a basis for the researcher to suggest that website administrators and information professionals spend more time with use case scenarios and explore ways to engage in usability testing efforts with individuals from the community. This suggestion will become even more apparent as the discussion moves forward to address interactivity and technical issues.

Differences in Focus of Content and Regulation

One theme that continued to appear throughout the analysis is the degree to which states differ in their regulatory positions and what elements they deemed to be most important to relay to information seekers. The consideration here is whether there are overall implications to the effectiveness of information based on these incongruences and what this means for producers and other stakeholders seeking information as they travel through multiple states with cattle. One way states differ is in the way they communicated about regulations. Some of the states speak about the ruling on Animal Disease Traceability (ADT) as a state regulation that was created to comply with the mandatory federal ruling and other states discuss ADT as strictly a federal ruling with which everyone will need to comply. The resources often stress the need for producers to check with the states before they transport given the differences in the requirements between each state. One can imagine that without some standard documentation or link to the information in other states, producers and users can get tied up within state sites where there are differences in the way this information is presented. This is a perfect example of the way that presentation and framing of the

information plays a large role in the understanding of the concept and overall perspectives of the information seeker.

Specific states that present a more state centric perspective of regulatory power are Alabama and Florida. Louisiana presents a similar situation. The state's central attention is to a technologically advanced traceability system that was developed in conjunction with a grant through federal government administration. The relationship between the state and the federal governance of the situation is murky depending on the state one is visiting. While technological innovation is exciting and important to share, it adds another element of confusion to the understanding of the practical issue of compliance and protection at the current moment.

The differences in perspective of governance is a large vulnerability with which there needs to be some centralized organization in order to make compliance with all states a possibility for those who transport across state lines. Part of this diversity can be explained by each state's decision on whether to comply with the final ADT ruling. States are able to opt out of enforcement; however, they will not receive the same financial resources. Compliance is not a difficult endeavor for most states because the majority of the beef cattle transported from the cow/calf operations are under the age of eighteen months and therefore exempt from the ruling stipulations. States that may have more difficulties with this are states where there are operations engaged in the middle backgrounding phase. According to APHIS, at this time 47 out of the 50 states are cooperating with the ADT ruling. The only states not doing so are Wyoming,

Massachusetts, and New Hampshire. This does not directly reflect much of the diversity seen in communication about the regulation; however one could suggest that certain state departments have acted quicker in formulating the state's specific plan for multiple reasons.

As previously mentioned, the reason contents of these websites are so different rests a great deal on the context of the institution as well as the structure of the technological infrastructure and the cultures of work within the population of the state. Administrators may be focused on providing content to areas with limited internet connectivity in remote areas within the region. This will influence the types of resources that they feel are compatible. In some instances there is evidence of attention to bolstering a sense of community, for example, when the search terms retrieve a number of newsletter drafts that are intended for circulation via the postal system. Some websites are turning to blogs that are periodically updated as a way to promote engagement.

Newsletters and blogs have good and bad aspects. The newsletters are often easy to read, but they are often quite the same from month to month. There are often duplicate stories for both blog and print editions and the body of the discussion only skims the surface of an issue. When these publications all show up first in a search query the editions are all primarily the same content and there are ten to fifteen editions so an information seeker is shut out from any variation in the granularity of the

material, type of resource, or subject matter. This is a primary example of how the content can seem to be relegated to one specific focus or content type.

Another way the states differ that affects the focus of the content is when one state has higher scores for relevance in either the state Department of Agriculture or the Extension. As the figure 5.34 and 5.35 layout in chapter 5 demonstrates, some states have disproportionate relevance measures in either one website or the other. Naturally this is indicative of the amount of information that is actually available on the topic. Normally one would assume that the websites function completely independently of each other. The researcher speculates; however, that in states where one is extremely low in performance, the other will be the source that is more often used to find state based information. Users will miss out on information if they only know about the source that has the small amount of information and even if they do know about the other, they will not get as accurate a picture because these two resources are representing two different entities geared toward different purposes.

Finally in thinking about differences in focus demonstrated in the content, the network analysis component of the research demonstrates rich variation in the information resources that state websites linked to. The images in chapter 6 show the isolation of some websites versus others who were hooked in with a network of material that is most commonly shared across the nation. The problem with the nodes/ websites that are disconnected from the major hubs is that they are bypassing the main federal information communicated to the nation about the current ruling. Implicit in this

omission is the statement that the website's focus is not on the federal information about regulation, at least, it is not important for the information seekers of the state to have direct access to this.

One needs to ask whether there are other channels and ways of relaying the information to state producers so that individuals are indeed prepared in the event of an outbreak when certain protocols and government procedures will need to be relayed to the population within a very short window of time. Certain state websites may or may not understand the implications of leaving these resources out of the conversation, but from the researcher's perspective this omission suggests that administrators are interested in closely tailoring the material that they provide for their users to best understand and use the material. As a result the inconsistency of the messages that states provide is problematic when considering the need to transport cattle from state to state. This leaves large gaps in information provision, as the analysis has shown, in areas where the information need is great and there is potentially a large disparity in income level and access to resources to satisfy that need.

Alabama and New Mexico are especially poignant examples of states in isolation. Alabama, one may recall, is one of the states whose regulatory material focused on the state regulation. Both Alabama's sites have no relevant external links. With the combination between this disconnect and the focus on state ADT, could this be a problematic situation in the event of regional or national emergencies? Are information seekers from the state missing out on important resources that other states around the

region and the nation are connecting their users to? New Mexico is in a similar situation as a border state with no federal, national, or international external resources. This puts the state in a position of great vulnerability. One wonders what this means for safety and efficiency of cattle as they are transported across the borders. This disconnect could be a tacit reflection or representation of the culture of the state establishing independence from federal oversight. In cases such as these, balancing the state focus with the national focus is difficult. Efforts are needed to show both community and country representations in connection with the singular website and its contents.

The Importance of Interaction – A Paradigm Shift

The findings of this research suggest the need for a cultural shift in how these two entities define information access. As established earlier in the discussion, the results pointing to areas of misdirected concern and unmet information needs are evidence that there are currently not many effective channels for interaction between the information seeker and those who are creating and managing the information resources on the websites. This is especially apparent in states where there is frequent discussion of mission and vision and little talk of programs, events, or opportunities for actual participation. Perhaps another question to ask is, what does the participation look like? Are there only workshops and lectures? Are there panel discussions and calls for suggestions from the community that change the hierarchical structure of the situation? Engagement in the latter may help improve the understanding of the issues

and the dialogue between the information management and the information seeking groups.

Lack of interactivity is also visible in the finding that there are very few instances where state resources address frequently asked questions (FAQs). Are there opportunities offered on the websites where producers can ask questions? If there are, are the producers and other information seekers using these opportunities? There may be feedback and communication, but if there is no effort by the administrator to address the questions and comments given or promotion of the website's capabilities as a resource, the effectiveness of such a tool is limited. Having this available avenue to ask questions is essential to equitable access. A lack of ability among information seekers to ask questions has the potential to lead to lack of involvement in compliance and only a partial understanding of exactly what is available as an online resource.

Currently the analysis shows that the interactivity measures commonly available are those that are easy to execute and essential for specific purposes such as the open fields on a form to submit for registration, or a comment box at the bottom of the blog. Perhaps the states have a link to "like" them on Facebook or follow them on Twitter. These elements are much more indicative of the top-down, one-way, traditional hierarchical flow of communication from the expert to the citizen.

As is demonstrated in multiple ways in multiple disciplines in the last decade, communication about such problems that involve a large spectrum of the population in various ways calls for ways to communicate that capitalize on the users voices as

important additions to both the conversation and the problem solving efforts between citizens and governing structures. An especially poignant example of this is reflected in the changes that the field of information science has experienced. This is explained as a paradigmatic shift toward more user-centric and co-created methods of framing analyses of information exchange and management within the reference environment be it an online data repository or a university library. Each area of the discipline is shifting to deal with the information needs of a consumer base that is moving towards online access to content and increasingly participatory digital activities in all arenas of daily life (Thysen 2000; Van House & Sutton 1996). Important in this shift is the acknowledgement of the user's lived perspectives as inherent in the construction of the information system. It is imperative that the online materials incorporate approachable avenues for connection. Orchestration of such a feedback loop will have advantages for both the system managers and the users of the information.

Naturally there are multiple barriers for the web administrators and information professionals to instrument additions such as applications and programs that feature greater interactivity and participation. Available budget and staff may be the biggest limiting factor for the entities. Certainly issues of material cost, time spent developing, and post-implementation management are key constraints to creating more involved information resources. There may be fear that no one will take part, that it is a waste of time and resources with little understanding of the return on investment. Yet it is this post-implementation management that will suggest to users that someone is paying

attention. Currently it seems as though a lot of the websites have set up a structure so that constant and consistent updates will not be necessary. This is apparent in the resources retrieved through the analysis that discuss issues and defunct regulations dating back four and five years as well as the amount of broken links and malfunctioning social media connections. The lack of attention to updating the resources communicates a lot about the priorities of the entity especially when so much of business in the US is done online, and often via mobile operations.

The researcher acknowledges the difficulty among states to fit such changes within budget requirements and the often constrained work force of the information management teams involved in the web presences; however, the need for this shift is connected to that of the traceability regulations themselves. In the face of detecting disease, it is less of a question of if and more of a question of when and how prepared the producers of the state will be. It may be hard to see the consequences on something such as this until it happens. There may be smaller ways that professionals can begin to shape a sense of participation, interaction, and efficacy among information seekers. For example, the search engines play a large role in the ability to access relevant information and often these search engines offer little to no options and assistance to users. Disclosing the search engine that powers the retrieval, as well as providing tips and advanced options and tagging or flagging capabilities are some general additions to foster self-efficacy in search and to gauge users perceptions of the information retrieved for the query they used and the needs that they had.

Information professionals working in agricultural communication and information services may find themselves in a position of flux similar to that of library scientists in the previous decade as e-publishing, e-readers, and digital repositories became the norm for storing documents and sharing knowledge. This shift will be important to navigate proactively especially in the area of traceability and regulatory information since the changes in regulations, continuous updates to ruling and specific state based requirements create such a dynamic information environment for those who need this information. Additionally, the issue of biosecurity and the quality control aspects of the regulations themselves play such an important role in the livelihood of producers into the extended future that there needs to be attention to effective sustainability and security of these information channels for resource exchange as well.

Another component in the discussion of a paradigm shift towards interactivity for users is illuminating the relationship between mobile use and interactive function. Mobile technology is often more suited to interactive use. The majority of the states that have high mobile use associated with beef cattle operations have an average amount of interactivity. This suggests that the state websites are beginning to move towards providing more opportunities for mobile interaction with the resources. Many states; however, are less equipped to deal with mobile access because they are not compatible with mobile devices.

This finding suggests that web administrators need to take steps to update the web interface and its contents to support mobile access. If not, these websites continue

to fall short in providing equitable access to certain producers and other stakeholders. In particular the websites may be excluding those users who are associated with racial and ethnic minority groups. Studies in the recent past discuss that a larger population of individuals of African American and Latino backgrounds use mobile devices as their primary mode of connection to online resources (Pew Research Center, 2015).

The USDA provides many resources to foster racial and ethnic diversity of the nation's farmers and to bring new farmers into the fold, yet it is essential that the avenues to accessing all information be an effective representation of this effort as well. Access to state web material plays an important role in this process. Contingent in adapting to a shift towards interactivity and fostering participation in access is a willingness of the information providers to learn, manage, and adapt to new ways of working.

Technological Barriers

Technological issues hindering effective use are no different than topic coverage in their ability to become tacit barriers to equitable access among producers and other information seekers. The types of issues that appear throughout the analysis process are best addressed by discussing different categories of these barriers including content access, search engine specific issues, resource redundancy, formatting and functioning of resources, and elements of website design.

Content Access

There is a large amount of variation in the circumstances surrounding the accessibility of content retrieved from the search engine queries. Some of the websites have very large documents or resources with a lot of high resolution imagery. These files take a while to download even with a high speed internet connection. One example of this occurs when retrieving information from the Alaska state department website. The search results contained PDF materials that each took several minutes to download and view. Depending on the individual's speed of access and the amount of time she has to wait, these resources may be problematic to download and to scan the content effectively.

Other websites, such as the South Carolina state department website, have little to no relevant content. Often the websites with limited content were those recently updated with a streamlined design and conceivably greater mobile compatibility. One speculates that these sites are in the process of undergoing content migration. Additionally, having little to no content may mean that information is provided elsewhere such as through a beef board or a cattle association. In the case of external resource availability; however, it is essential that the website provide a link. This is not often the practice. The available links themselves are a significant barrier to access. Often they are broken or never updated. Almost every website has at least one broken link. This is an example of a simple issue of quality control that is easy to remedy with proper web upkeep.

Search and Search Engine Issues

Sometimes in the process of using the website the researcher uncovered the existence of relevant material that did not make it into the retrieved results. This is indicative of a problem with the search engine, but it also suggests the existence of potential problems with the method used for tagging or naming a resource within the system. Another factor to note is the high use of Google Custom Search as the search engine of choice. Further comparisons between relevance scores and search engine use are a potential avenue for gaining better understanding of any relationship between the website's search engine choice and the ability of the user to access of relevant information from the website.

Additionally websites often have cryptic or erroneous titles for documents and inconsistent naming conventions. This may influence the retrieval of results and hinder the ability to assess what is retrieved. It is common to find the same document under two different titles. Fixing this will require greater forethought for information professionals in an effort to establish common naming conventions. This is an especially important consideration because users will not be accustomed to the culture of work within the institution or department and titles without a proper descriptive heading are meaningless until that resource is opened. This slows the information seeking process considerably.

Extension website searches are especially variable in the scope that they cover and how they function. In one example, two state Extension websites employed a

search engine type which only allowed for a certain length string of characters. This is not explicit in the instructions so the researcher went through several iterations of the query in order to understand the limits of the search field and effectively find information. This is a problem because it immediately excludes those individuals who are inexperienced with the eccentricities of search fields. It means that a lot of useful information remains buried within the website repository.

Resource Redundancy

The repetition of resources is a common occurrence on the majority of the web pages in one of several ways. Sometimes more than one draft of an article appears, which suggests there is not much effort taken to differentiate between the institutional repository archives and the external scope of the search content for users. It is essential that this separation exist. If not the document drafts crowd out the other potential retrieved resources. Users who are pressed for time will not sift through multiple versions to find new content. Additionally, if the version before the final version is accessed and used, it may not be the most accurate. This could potentially spread misinformation.

The retrieval process often yields a lot of seasonally produced newsletters especially from the state Extension websites. The subject matter and even the wording used in each edition is often similar and it is sometimes copied and pasted directly from other content. Often, the documents that the states are borrowing is text that is directly from the federal information. This may be an issue of time and budget for the web

administrators. Repetition is problematic for information seekers who are looking for a broad understanding of an issue. There is less opportunity to find state specific resources as well. They will not be exposed to more than one dialogue across multiple retrieved records. There is a tacit message to the user in this situation that the issue they are searching for is not dynamic nor a priority when in fact, as the study continues to note, there are rapidly changing dimensions to the situation.

Redundancy also occurs in the websites that host weblogs. In several instances these blogs are formatted with a sidebar that shows the most recent post. The page will also provide tags for the related keywords in the sidebar. Because that sidebar displays the content, every single blog post shows up in the retrieved results even though the central content often has nothing to do with cattle identification and traceability. Sometimes the majority of the records retrieved are irrelevant because of this and the user must do a lot of sifting if one wants to actually uncover new, relevant material within search results.

In these examples it becomes clear that if information professionals can begin sufficient testing of the functioning of the content management process apriori it will benefit the information seekers in the long run. If users consistently come up short while looking for new information, the desire to return to the Website and to trust the resource diminishes rapidly. The researcher stresses that state websites need to capitalize on their position as an authoritative voice by presenting themselves as such in the eyes of those with the information need.

Format and Function of Resources

Beyond the technological issues with the container of the information and the management of the retrieval of the resources from the container, the analysis revealed eccentricities with the format and functioning of the resources themselves that are important to address because they impede or change the experience with the content. First the amount of social media connections that are available via the webpages and resources is surprisingly higher than the researcher originally expected; however, there are instances where that media is not functioning properly. This was the case for the Illinois Department of Agriculture. In a similar issue on one Alaska webpage social media streams or displays are obtrusive because they are large and dynamic. This made it much more difficult to filter through and visualize meaningful content. States should consider the most effective ways to use social media. Linking to an external feed may be preferred to posting the content directly on the page as a way to effectively relay vetted information versus displaying streams of content from multiple sources.

Legibility is a major concern with the resources. This goes beyond the simple need for greater overall mobile compatibility to the traditional web browser window display on the desktop. Several sites have font that is too small and/or very light. Others contain an overwhelming amount of content on a single page. Attention to legibility is especially important given the average age of the primary operator is 58 and the individual may or may not be in a situation with proper lighting or have a lot of time to adjust the font to a suitable size.

In further consideration of the format of the resources it is important to acknowledge that the PDF is the ISO open document standard format for online materials. Some states provide little to no PDF resources and there are a couple of states that use only HTML formats. As mentioned earlier in the discussion this limitation is especially problematic for states whose websites are not compatible with mobile devices such as smartphones or tablets. It is also a major issue of equitable access since non-compatible HTML is nearly impossible to work with on smaller devices. Wisconsin is an example of a state that only offered HTML resources and is also not compatible with mobile devices. The researcher speculates that larger usage of PDFs in states such as Alaska correlate with the state's need for easier access. This is one state that has a lower percentage of internet connected operations reported among their producers. In such instances it may be easier for individuals who need to print the resources from a computer external to their operation.

The use of other file formats beyond PDF and HTML have both good and bad aspects. The need for access to sometimes costly proprietary software and higher speed internet connections means that these states who use these other formats are potentially excluding that portion of the population unable to garner these necessary components. From the other perspective, using these formats does allow for the transmission of material that can be used in ways that PDFs and HTML may not easily facilitate. These are issues that each state must assess according to their personal demographic profile as demonstrated in this analysis. The suggestion from this research

is that the variation in the populations and the focus on smaller scale cow-calf operations means that the most effective format for material will continue to be the standard PDF.

Website Appearance and Design

Website design and factors related to the appearance of the website are also important to address not just as part of the aesthetic experience, but also because of some of the noticeable patterns that correlate with these appearance factors. Several websites are newly designed with higher resolution graphics. In many cases one can identify the attention to mobile compatibility and legibility as well as focusing on attractive designs to enhance the experience. These websites are often the ones with less content and the lowest relevance levels. More exploration is needed in this area to ensure that the absence of quality content has to with the timing of the analysis and that content managers are indeed in the process of designing and migrating content to the new format. Some of the more graphically complex designs are also problematic for those information seekers using dial-up and any slower form of connection to the Internet.

Design and usability are extremely variable components of the research. Small issues such as whether a visited links changes color plays a big role in the efficiency of the user's experience. Links rarely change color and there are many design elements throughout the website that are inconsistent across the body of resources. One example of this is whether a link opens in a new tab or simply switches from the initial page.

These are examples of inconsistencies of design that can become larger problems during a search session when the user is switching back and forth between records and new resources. Little attention to small details communicates a lack of care for the upkeep of the online information environment and may perpetuate feelings of doubt or distrust from users. Additionally, the ability to customize the search options is a rare feature. Customization is helpful to reach a range of users with specific needs. The researcher suggests that web administrators look to Usability.gov for design guidelines to ensure that the interface design meets the requirements as established by usability and design experts in the effort to uphold a standard of functionality among government websites.

Successes and Quality Performance Aspects

At this point in the discussion it is important to acknowledge the quality performance characteristics showing up in the analysis among the state websites. By looking at these aspects the researcher can begin to suggest best practices and takeaways for other states in the process of upgrading or assessing the management of their resources. It is important to note also that these best practices transcend the topic of cattle traceability and identification information resources and may be applied in multiple areas looking at complex social issues related to agriculture.

First, certain states excel at providing a large amount of relevant information and a broad range of subject matter about identification and traceability. What is it that states such as Florida, Kansas, Washington, and Michigan have in common that cause them to appear at the top of the list in multiple topic coverage categories? The

researcher wonders whether this is associated with high-powered institutional involvement in research. Specifically there may be more money devoted to beef-industry focused research due to high production levels. The majority of these states also have a higher perceived degree of regulation. Greater need to communicate about regulations may be a driving force behind more complete topic coverage especially in cases where issues of compliance and security measures have a history of being important because of past disease outbreaks.

The Colorado state Department of Agriculture is an example of a website that has unique resources on agricultural threats and biosecurity. Colorado as a state demonstrates the highest coverage in this subject area. States looking to improve their resources and to provide more resources related to agroterrorism and biosecurity are advised to look to Colorado's state resources for examples in this area.

In some cases there are news stories provided on the websites that played a double role as an educational resource or to communicate about regulatory issues. The use of local stories helps relay information that otherwise may not be discussed. It does so in a way that is palatable, relatable, and has better chance of resonating with other producers in the area. In one example the news was specifically about individuals cited by law enforcement for improper registration and identification of cattle, which was a way to address the new legal consequences of noncompliance with a direct application. Another website provides an example story where traceability methods helped to deter theft and the wranglers in question end up getting caught. It is important to stress that

these stories are not contrived. The sharing of stories is one way to subtly engage an audience and relay information in a form more powerful than bullet points and lists of rules.

Additionally while discussion of research as a topic is quite low overall, when the resources do discuss research there is more attention to discussing the entire process and not just reporting the statistics. This is important because it shows an effort among those creating the content to be transparent in sharing the details. With this, care is also needed so that the writer takes into account the public's understanding of the science. Continuing to discuss the full picture of the research process, while working to eliminate jargon and technical terms that may frustrate and alienate those who have a different level or perspective of understanding of the scientific process, the resources are effective at bringing producers and interested parties into the discussion and providing a better overall understanding.

An interesting aspect that the analysis brings to light is that the uses of information format and the scores for information quality are both fairly consistent for all the states and tend to be positive in both accounts. The predominant use of PDF and HTML as the formats for content delivery shows an attention to providing resources that are easily accessible to the majority of the information seekers. Additionally, each measure within the items that define information quality standards score greater than 50% on average over all fifty states. This shows across the board attention of these websites in adhering to a general level of performance. It is unclear whether there are

guidelines for the state websites to follow in the same way as there are for federal sites. Future studies are needed to engage with professionals on the information management end of the flow of resources as well as the individuals on the other end of the resources: the producer experts and other stakeholders.

There is also consistent availability of user support on the websites. This is essential to establishing trust among users because channels to ask for help provide that avenue to communicating with the administrators, allow administrators to keep abreast and respond to issues and ideally promotes a culture of greater transparency. In certain cases such as Arkansas, Mississippi, and New York these sources to connect for support are more difficult to find. These states may need to look to other states to see how the interface can provide more effective access to support. In all cases, where certain states excel and others struggle, the purpose of this research process is to provide an overview of strengths and weaknesses so that states can learn from one another.

Suggestions and Best-Practices

Finally, out of this discussion come suggestions based on the analysis that the researcher deems instrumental in forging bridges across gaps in access to state-based web content. One should note that these suggestions and best practices relate solely to the two state web channels and the experience of using the search engines on the websites. This is not an overall value judgement of resources on traceability in the US and it is important to recognize that producers and information seekers may find answers to their questions from multiple channels both government and informal. The

appendix A. 7 provides a reference list of example resources that offer additional perspective on the information landscape for cattle traceability information in the US. These are resources that the state websites may also consider making available to their website users. It is the hope that following through with the actions listed below will ease vulnerabilities within the state based information network.

- States with lower star-rankings overall should look to the states with higher star rankings especially those in the four and five star categories for ideas on content management strategies and interface design. (Chapter 6, Figures 6.13 and 6.14)
- To get the most applicable/customized perspective on ways to improve overall, it is suggested that states look at higher scoring neighboring states and states that are similar in their demographic profile. (Chapter 6, Figure 6.14)
- States that have found through the analysis in chapter 5 that they are deficient in one area will want to look specifically at the higher functioning states that were listed in the context-based comparison with them. (Chapter 6 Tables)
- States with similar needs should push for more collaboration and less duplication of effort when it comes to sharing tools and education resources. (Chapters 5, 6, and 7)

- Widespread attention is needed to the organization of website content within each system. Taking the time to sort out older resources and the drafts of documents into an archives away from public retrieval will keep the old and irrelevant information from coming up first.
- Documents within the system need to have a consistent method for naming and tagging records to improve relevance of materials retrieved when searching.
- All websites need to become effectively compatible with mobile devices.
- Administrators and professionals working with the web interface need to spend more time engaging users from the community in usability testing. In the instance where user experience testing is limited, professionals should develop use-case scenarios based on the producer demographics in relationship to potential information needs.
- Web administrators should be looking to resources such as Usability.gov for design guidelines to ensure that the interface components and the resources housed within the system provide a standard capacity of access for all users.
- States that are isolated nodes in the network analysis visualizations should use the network visualizations to discover highly referenced resources that would be applicable to provide as resources on their own state websites.

- States should connect to the main APHIS resource for federal information on the ADT final ruling as well as the APHIS import/export information resource.
- There is need for a centralized resource network that connects the states and offers standard information for producers traveling with livestock from state to state so that anyone who needs it can have a clear picture of the documentation that they need and can check for any additional requirements and emergency information in the event of an outbreak.

These suggestions are supplemented by the list presented in chapter 5 that covers the basic elements that all state Websites should provide to their users in order to provide equitable access to information about traceability and identification. This list can also be found in the appendix item A.6 as a checklist for information professionals to use when evaluating the performance of this issue and other similar questions of access.

Use Case Scenarios

There are two different types of use case scenarios that the research will address. The first two examples present situation when the use of this mixed-method of analysis demonstrated in the research will be an important tool. The discussion lays out the way the research design can be used and extended to serve the situation and the groups involved. The other type of use case scenario takes on the potential perspective of a producer involved in a situation where they experience an information need. These

scenarios are hypothetical situations. The researcher shares such a situation as an example to information professionals of the type of perspective-taking exercises that may help them assess the needs of the users in their state. This may be integral in instances when there is not a lot of funding or ways to connect certain user groups yet the need to understand the operational process and speculate on the experience of the user is still great.

Use Case 1A: Rationale for a Centralized Information Network

A federation of information professionals that work in positions in the state and federal government are taking steps to safeguard the nation from the outbreak of foreign animal disease such as Bovine Spongiform Encephalopathy (BSE) and Foot and Mouth Disease (FMD). One of the issues that members of the organization find especially troubling is that the state departments of agriculture have different types of organizational structures and slightly different rules for transporting cattle and establishing cattle industry operations within each state. Through conversations with Extension agents and veterinary professionals, these professionals are aware of the growing need for a method of communication that will allow for centralized up-to-date communication about risks for disease outbreaks, quarantines, and to access state regulations to expedite transport, inform producers, and enhance compliance around the nation.

This working group has the difficult task of figuring out how to do a couple of different things. First and foremost, they will need to be able to convince those in

charge of funding programs of the importance of such a network. They will probably have to compete with other issues that are also in need of that funding. They need to figure out a way to show the complex problems of access to information in a layout that is simple and palatable to the heads of the organization or agency to whom they are appealing. Additionally, they will need to determine exactly what the current landscape of the information resources look like in order to use any positive aspects to their advantage and to assess and categorize the various needs across the nation. This will then lend itself to creating a proposal to address such issues as the itemized allocation of funding, need for personnel, software, and planning that will all be needed to create such an information network.

The network visualization will show the governing bodies where there are states that are not linking to resources successfully given the search terms they used and the relevance of the resources retrieved. They professionals are able to see the whole network of states and their external resources together. This helps them make their case when they show the panel how the APHIS import/export information page is only an external link on approximately ten percent of the state websites. The group is also able to extend the social network analysis application to include multiple variables such as economic differences and aspects of internet connection beyond the current example. The framework allows for these individuals to tailor the visualization to the specific needs of the situation as the next use-case will explain in greater depth.

Use Case 1B: Invasive Species: Addressing the Spread of the Hemlock Woolly Adelgid

The Hemlock Woolly Adelgid or HWA is an invasive species threatening the health of the nation's population of hemlock trees. The HWA strategic plan for 2014-2018 calls HWA the single greatest threat to the hemlock species (HWA Coordinating Committee, 2013.) The Forest Service has done a lot to suppress and defend against the spread of the pest to areas outside the seventeen states where infestations have occurred. One of the important things they note is the need for public outreach to educate individuals on ways to mitigate the spread further, such as not moving firewood from state to state. The public also needs to know about what to do if they do find an infestation and who they should contact.

In this hypothetical situation, the US Forest Service working group dealing with the strategic plan in the area of outreach needs to know if states other than those with previous initiative partnerships communicate with state website users seeking information. The group wants to know what information resources they are using and whether the messages are actually able to be accessed by the people who need them. This is a large undertaking and they need a way to present it in a report beyond just statistical calculations of the criteria. There may be additional considerations for some of the states that they will want to propose and they need to have some way to show the current gaps in the resources if they are there.

This situation is less of an issue of social complexity than the example of cattle traceability information because there is not the level of industry, producer, and

consumer involvement intertwined with regulations and security risks; however it does deal with an issue that involves the security and sustainability of an important natural resource and it does deal with an issue that is part of both state and federal efforts to regulate. The information landscape will be very diverse. The working group uses the example from this research to create a three phase project. First, they develop a content analysis based on the essential information needs that they have delineated with scientific experts and the government officials. They look at what is available from each state's website – choosing to look only at the state Extension website. Then they assess demographics in conjunction with their findings. Instead of using the NASS agricultural census from 2012, they use the US census because the audience base they want to reach is much broader. They tailor the demographic categories to suit their needs. Additionally they develop new statements of proper access based on the relationships between these demographic categories and the information categories in the content analysis.

In the second part of the analysis, the group looks at any external links to information and maps the links and connections to see what resources the websites share across the nation and to assess whether the states are indeed linking back to the federal resources the working group holds to be the most important references about the national situation. In the third part of the analysis they do focus group tests with groups of interested individuals in which they ask them to find certain information using state materials and to discuss level of understanding, ease of use, and perception of

relevance they found searching for information on the website. They also ask about problems or questions that they have during and after using the resources. The working group is able to present these results in a report to the HWA initiative administration and to create best practices and resource references for the state Extension to use. In 2018, as the initiative reevaluates their efforts, the HWA outreach team plans to do a second round of this analysis to see if the states performance in providing resources about this subject change for the better.

Use Case 2: Traceability for a Small Scale Cattle Producer in Texas

Javier and his family own a herd of cattle and a small ranch in Texas. He became the primary operator in of the ranch in 1980 when his father turned it over to him. He is sixty-five and he has lived on this ranch his entire life. The ranch is in a very remote location and the members of the family that help with the cattle also have jobs in which they drive a long way outside of the ranch. This helps to supplement the small income that they get from selling their calves at auctions each year. Over the years Javier finds the ranch to be in the 5,000 dollar to 9,999 dollar income range depending on the weather, the health of the animals, and the market prices. When they take the calves to auction they will use back tags to quickly mark that the stock are from his ranch. Javier has heard about other types of identification, the RFID tags and other identifying hang tags, but he really cannot afford to do all of that and keep his herd and family fed properly. He is also skeptical that the tags will get torn out easily and he really is uncertain of how they work. There are vaccinations that he knows he is supposed to

have, but if everything is going well he doesn't always do that because he needs to save that money if he can.

One of the annual auctions that Javier attends is closed this year, but there is another one going on across the border in Oklahoma that his neighbors told him was good for them last year. His cousin who sometimes goes with him has a bull that he wants to try to sell, but he cannot go with him like he normally would. Instead he asks Javier to take the bull with them to the auction and bring him back the money. Javier agrees since his cousin has helped him out with his finances last year when they were short on some payments. He realizes as he plans for transport that he has heard from some of his friends who keep up with the news better than he does about some new regulations for traveling with older cattle outside of the state. He does not have a lot of time to look up information about it, but the last thing he needs is to get fined because he does not have the correct paperwork at the moment for this bull he is taking for his cousin.

The ranch doesn't have an internet connection, but Javier and his family each have smart phones which allow them to access the internet for some things. He finds it hard to read some of the websites when they are not made for the mobile phone, especially when he is outside. The sun makes it especially hard to see the screen. Javier would have gone to the library in the nearest town if he had known about this situation earlier, but for now he uses his smart phone to access the internet. He finds the Oklahoma State Department of Agriculture by Googling Oklahoma cattle transport laws,

but he cannot see the site or where to search from there because the site is not equipped for his phone. It is loading really slowly too. His son showed him how to enlarge the screen, but it is not working for him very well to slide the picture around. He tries the Texas website, but it is the same, he cannot find a way to search in the small size of the font. After some consideration and discussion with his wife, Javier decides to chance it. He does not think it will be a big issue as long as he just does what he normally does. He's not even sure if there is an added fine for this and he does owe his cousin a favor for all the help he has given him in the past year. Next time, he makes a mental note, he will try to remember to go to the library beforehand.

Javier's situation is just one example of the process that information professionals in the state can use to begin to think about and discuss the implications of the current resources that are available on the website for their producers and to do so in conjunction with those constraints that may hinder access. One could do these for multiple phases of the cattle industry, with different demographic characteristics and in thinking about specific situations, such as what might happen when producers search for emergency information in the case of a disease outbreak. These use-cases, while beneficial in developing an understanding, are not a substitute for actually engaging in research with the producers and other cattle industry stakeholders. In the concluding chapter the researcher will cover thoughts and ideas for future phases of this research one of which extends the use-case into user experience testing using focus groups.

CHAPTER 10 - CONCLUSION

A major outcome of this research is that it provides a better understanding of the landscape of beef cattle traceability information resources from the state websites across the nation. This understanding is useful to the information professionals at the state and federal levels and the policy-makers and project managers throughout the country who work on issues related to biosecurity of the nation's cattle industry. In the previous chapters the researcher laid out the process to gaining this understanding by developing an assessment framework and then reporting and discussing the findings from the two phases of the analysis. The research also provided recommendations and use-case scenarios as examples for future use of this study as it applies to practice.

Chapter 1 explored the problems that the research addresses and introduced the issues and questions that arise from these problems. Chapter 2 reviewed the literature from scholars in multiple disciplines including: information science, agroterrorism and biosecurity studies, agricultural economics, and agricultural communication. Chapter 3 introduced the new CIAV framework that arises out of the combination of two other theoretical frameworks dealing with access and citizen user needs. Chapter 4 laid out the methods that the phases of the study used and addressed measures for reliability of such methods. Chapter 5 reported the results of research question one on information resources, chapter 6 the results of research question two on the equity of access, chapter 7 the results of question three regarding a gap analysis of the information network, and chapter 8 the results of the fourth question regarding the overall

performance. Chapter 9 discussed the implications of the results and listed suggestions, best practices, and three use case scenarios for information professionals to use in the future. This final chapter concludes the research by reiterating the specific findings, discussing some of the limitations and issues that the researcher encountered, and providing multiple avenues for future research based on this initial study.

Major Findings

Research question one asked about the resources that are accessible to each state in the US. Here the study found that there is a large amount of information resources available, but they are often limited in the scope of their topics. The absence of comprehensive coverage will be problematic in certain situations. For example, there is little discussion about scholarly research or information that discusses and seeks to overturn myths and misinformation. The area with the most coverage is information that addresses guidelines and regulations, but the subjects of basic information and information about security, disease, and risk need to be covered more often across the majority of states. Another issue to note is that the relevance of the retrieved resources varied often among the states and particularly between the state department and that of the Extension websites. Finally, many states scored lower on interactivity and currency levels. Both of these deficiencies have their own implications for users trying to satisfy information needs.

Research question two asked about the demographic diversity of each states' cattle operations in relation to the information resources found in the state and asked

whether this relationship is conducive to producers' equitable access of these resources from the websites. The researcher introduced a tier system to rank the states. This method is based on the state's performance as it relates to specific demographic factors that are laid out for comparison with perceived, context-based statements of information need. The ranking system divided the performance level of the states into five categories based on a star classification system and mapped the states using corresponding colors that allows one to see the states and their ranks as they are located among their neighboring states. One of the major findings was the existence of significant vulnerabilities in the states that are considered major players within the beef cattle industry. These are states that have a lot of operations and/or a very high level of income from beef cattle. The absence of certain necessary components to access means that these states exhibit large amounts of disparity between information need and equitable resource access. These states need to work to improve their resource provision on the state websites in question.

Research question three asked about the gaps, strengths, and weaknesses in accessible information and communication channels within a network of resources. The social network analysis of external relevant resource hyperlinks revealed a major connected network surrounding the APHIS federal webpage that provides information about the Animal Disease Traceability (ADT) final ruling as well as the APHIS webpage about import and export. Many states do not connect with these resources and several state websites have no external links. The network visualization allows one to see the

websites that have the most amount of external links and to discuss what the nature and purpose of the available links suggest about the focus of the state website's resources, culture, and/or perspectives. The website with the most external links was the Vermont Extension site. This is unexpected because Vermont is not ranked very high in levels of beef cattle production. The visualization gave an overall picture of the external resources that the states provide as important supplemental material to those seeking information on the websites and may be a useful resource for web administrators in all states to see what resources are out there that the states deem relevant to the issue.

Finally research question four asked which state overall provides the highest performance when it comes to equitable access for state producers and stakeholders. To answer this question the researcher reviewed the answers to the other three questions and looked holistically at the top scoring states for each portion of the analysis. Florida and Kansas stood out nationally as the first and second top performing states respectively across the measures. From this understanding, the researcher recommends that other states look to these two states websites as exemplars in providing information about cattle traceability to producers and stakeholders in their state. As a result of the findings of the research questions, suggestions and best practices are listed in the discussion in chapter 8. Beyond these suggestions and applied uses for the methods, the researcher acknowledges the need for another qualitative component to complete the CIAV framework. This qualitative component corresponds

with the sense-making component of the research framework as proposed in chapter 2. One recommendation to fulfill the picture of equitable access is to engage in a third phase of research that looks at the user's experience with the materials in a focus group setting.

Future Research

Proposing a Third Research Phase

The underlying reason for a third and qualitative phase of the research is to correct for the missing component that addresses the user's lived experience in the evaluation process. This phase is beyond the scope of the current analysis and yet an important component to recommend for future work. As discussed in the methodology of this study the information seeking component within the CIAV framework introduced in chapter 2 is defined by the actions and experiences of the users as they engage with the material in context (McBride & Matthews, 2011). By observing and speaking with the cattle producers during the process of identifying strategies to deal with an information need, the research gains clearer understanding of the actual experience of access to information from the user's perspective.

Phase three uses focus groups in multiple regions of the country to facilitate discussion of issues related to the process of seeking information during hypothetical situations of need such as disease outbreak or attack. Focus groups are chosen to facilitate dialogue within a peer group. The group discussion allows the researcher to hear nuanced views and experiences during one span of time at the same time thinking

of the producers' comfort level speaking on a topic. With a group of other producers in similar circumstances it may be beneficial for the participants to hear the experiences of another before they feel confident to speak frankly about the matter (Morgan, 1997). The researcher does two focus groups at two to three different regions of the country to highlight and give depth to the differences in perspective between producers in the different regions. Participants for the focus group include a purposive sampling of interested individuals because the results are focusing on the process and experiences of those individuals. The research is not applying these specific findings to the larger populations of cattle producers' nationwide.

The researcher starts by contacting Extension professionals in an Extension office in two to three separate regions of the country to inquire about the possibility to conduct focus groups with producers in the area at their facility. The focus groups will have between five and eight cattle producers whose operations are located in that state. Prior to initiating the group interactions the researcher develops a short questionnaire with demographic questions and this is presented along with the informed consent form to the participants.

The moderator speaks with the group of participants about their herd management and past experiences with cattle traceability and identification issues and information needs. Next, the producer poses specific scenarios for the participants. On computers provided in the room, the participants will work together in groups of twos and threes using the two state information channels previously used throughout the

research to walk through the situation. The directions will ask them to think about what they want to know, to talk about what they found through their search process, and to explain whether it satisfied these needs. Each group shares with the whole group about their processes. Additionally, the researcher may use card-sorting techniques to understand the relative importance of certain characteristics of information and the subject matter.

In order to collect and analyze data for this portion the researcher needs to use a note taker to record the conversation as well as an audio recording device and performs a qualitative coding process following Hsieh and Shannon's (2005) method. The data analysis of the focus group discussions will be based loosely on Glaser's (1965) constant comparative method. The reporting of the results for this phase of the research will be beneficial to Extension professionals and those involved in managing the information resources because the quotations from discussion and the diverse perspectives of the resources will give insight into how the professionals might structure information resources in light of those context specific, user-generated perspectives. Exact results are not transferrable, but the main ideas foster discussion and provide an outline for others to engage in similar development of information – seeking perspectives within the needs of the populations with which they serve. Additionally federal officials may use a report such as the type this phase three will create, to get a deeper understanding of the experience and perspectives of different groups of

producers. This in turn may influence or fuel future tactics for communication about risk mitigation and services in the case of an outbreak or attack.

Explorations beyond Phase 3

Many discoveries during the research process fueled more research questions and helped to set the stage for a body of work in this area. Information professionals using this process within their own information resource evaluation will find unique questions based on the relationships that arise within the specific information environment. The researcher addresses these new questions and presents potential ways to explore them in further study.

First, certain content variations between the states are very interesting because they seem to imply that there is a deeper story or understanding that an individual who is not a resident of the state may not understand. For example, New Hampshire and a few other states had animal disaster teams or agencies listed. One would think that there is a need among all states to have these animal disaster teams in place and have information about them somewhere, but they only appeared important in some. Why do certain states have these available and what does this mean in relationship to their overall communication about the issue of traceability and identification? Perhaps past histories of disease or state disasters of other kinds such as hurricane or flood influence this. Study about such motivation might be directed through interviews with state website content administrators and other agency personnel who would discuss perceived need of certain material to their state populations.

Another unexpected discovery is the amount of social media and web 2.0 connections and applications that appear among the state websites. Some use multiple types in one resource page, while some use very little or none in any of their resources and webpages. The variation is an important component to explore in a separate inquiry from the larger analysis and at greater depth. The researcher might look at what type the states used, how it is presented, the level of perceived participation and the currency of the participation. Potentially there would be interviews with administrators to ask about planning processes and decisions that drove implementation, as well as questions about perceptions of use and engagement among website users.

Relevance levels for each of the websites across all of the states vary considerably. This is true not only between states, but between a state's Extension website and state department website as well. The aspect of relevance is a major issue to the research because it is an initial measure of quality access for users. It plays a role in establishing each user's levels of trust and perceptions of authority based on outcomes of the individual search experience. One of the issues highlighted in the chapter 7 discussion about technological access is the need for better search engine function. It is unclear whether the lack of relevance in each case correlates with the functioning of the search engine itself, or whether the content organization and management of the system is the issue. It may be related to both. Further study is needed to understand the nuances of the search engine function and to determine whether the choice of search engine (for example Google Custom Search) is related in

some way to lower relevance factors. One might compare relevance scores with the choice of search engine, though this is only part of the picture. Many website search engines in the analysis are not disclosed to the public. More exploration is needed to find out what the engines are and why the websites decide not to disclose, or to use a well-known proprietary engine, and how that choice potentially affects what is able to be retrieved by information seekers.

Another recurring issue is that some states are different in the way that regulations, in particular the ADT final ruling, is presented on the website. Some focus on promoting the state as the official voice of the regulation and others describe it as a federal ruling with which the state's producers must comply. This difference is apparent in the content analysis when the webpages present the topic, and it is also echoed in the external linking practices of the state resources as seen in the social network analysis visualizations. The states that are more isolated from the larger network of resources seem to have a greater focus on communicating about (and linking to) the information and regulations coming from state channels as opposed to sharing information from those of national and international origin. More exploration is needed to understand whether there is any large significance of this observation. This might be done through deeper content analysis comparisons along with analysis of conversations among the information providers of the states to inquire whether this is indeed something the website contributors are focusing on and why the focus is directed specifically in that way.

An overarching factor which dictates the makeup and maintenance of the websites for both the State Departments and Extension is the state budget allocated to the creation and upkeep of the resources. Examining the budget is an important area of consideration in any further study of the culture of work for those involved in managing these resources and it could be another portion of the total information environment assessment. This brings about the need for both producers and the governing infrastructure to be represented in the CIAV model. Influences and constraints to access (the demographic element of the model) may need to be applied to both populations in order to fully compare the contextual access factors. The CIAV model is a work in progress that will grow with experimentation.

A final avenue for future research arises as an applied project out of the suggestions from chapter 7. The researcher reiterates the importance of creating an external network connection node, a web resource that links to state and federal information about import/export and transport regulatory information. This is an outlet that needs to be dynamic, customizable, updated regularly, and compatible with mobile devices in order to be a trusted clearinghouse for individuals to get information.

A tool such as this is necessary given the vulnerabilities that the study found and the current heterogeneity of the state websites' ability to transmit information. The variation in the websites suggest the importance of maintaining state individuality and autonomy in what they choose to provide; however, unless there are widespread revamps of each states' resource provision and search capabilities, there will continue

to be major barriers for the websites in establishing clarity and trust as a source that producers will turn to when they need it most. Ultimately the goal of a connecting website/node is to educate and relay the information that is essential in a timely manner. By keeping the connection external, producers will not have to navigate resources in multiple states as they plan their transport. More attention can then be directed towards providing access at a performance level of greater depth and breadth, working on elements of relevance and testing user experience among different user groups. This resource would ease financial and physical burden on states to conform as fast as is required to ease current vulnerabilities.

Issues and Limitations of the Research

Just as the results led to the discovery of new avenues for research within this body of work, there are also issues and limitations that need mentioning. Many of these limitations suggest future work that will flesh out issues at a greater depth than the scope of the research can do within the parameters of the research design. The first important limitation is the absence of the third and final phase of research, which will be executed in future study. Additionally studies with content analysis typically utilize multiple coders outside of the principle researcher. In this case there are limited resources and time for employing external coders. The researcher may miss some components that others will cite as important considerations; however, the researcher took multiple steps to ensure the best possible validity and reliability measures by testing for inter-coder reliability with another participant scholar and testing for intra-

coder reliability to assess changes in perspective and definition over the course of the analysis. Both of these measures are reported in chapter 3.

Another issue discovered while discussing results of research question two in chapter 6 is that sometimes there are conflicting issues to access for a state. Infrequently, but notably it may be hard for one to judge which issue is most important to the state. A lack of individual producer perspective makes it difficult to understand performance as accurately as one would like. For example, one statement for evaluating context-based need suggests that having more images within the retrieved resources is better in certain cases because it will enhance learning aspects in areas where English is not always the main language. This is a valid statement, but it is also the case that if these areas are areas where there is less access to reliable and/or higher speed internet connections for operations, having more image rich resources that take longer to download may be a hindrance to access. Which is most important? In some ways this limitation is also a beneficial consideration. It highlights major road blocks that information management professionals may run into, but it does add an unexpected component of complexity not originally accounted for in the formulation of the tier system. These issues will need further attention from the states on a case-by-case basis. Another way to address this may be in the use of a structural equation model in lieu of the tier system, such as a Multiple Indicators Multiple Causes (MIMIC) model. This will be a focal point for future research as well.

One question that continues to emerge in the research is the uncertainty of the actual level of access and what proportion of the perceived audience is using these resources. There are two aspects to this question that blur some of the assumptions behind the research. First it is not entirely clear whether information seekers would choose to use these two state resources to get information or whether they would choose to turn straight to either federal resources such as the APHIS ADT page, another USDA page, or whether they might turn to a private organization or cattlemen's association with whom they get the majority information. Here one might suggest that the private organization or association is not something that is accessible to everyone. It may have certain agendas based on the financial support received and the affiliation of the members involved.

Second, producers of one state are not limited to that state's resources and so information seekers may choose to look at other states where they know the information is easier for them to access and use. How can one characterize this as a vulnerability? While these questions are confounding factors that the research cannot answer at this time, there is also justification that the nature of the subject (the risk involved for multiple communities in distributed locations) creates a need for state specific information and for authoritative resources from government and research entities. From the perspective of the researcher the need continues to outweigh the questionable current website usage statistics. Further study could assess the levels of

access and perhaps explore whether there is greater access when changes occur post-assessment to implement more equitable accessibility.

An additional issue regarding definition and relevancy of content areas that were on the fringes of categories demanded further attention and clarification to maintain standard treatment throughout the analysis and are important to note for future study. The first content area is information retrieved pertaining to dairy cattle operations and production. The researcher wishes to maintain the boundaries of the study specifically to beef cattle information, but the reality of the resource analysis process is that often the dairy cattle information contains relevant information for all cattle producers whether dairy or beef. Sometimes it is difficult to distinguish which type of production the resource is dealing with. As a result, the researcher chose to count dairy cattle information as relevant with the understanding that some of the elements potentially apply to both types of production. There may be some crossover in the management of resources at stake should a disease outbreak occur.

The other fuzzy definition causing some confusion is the understanding of traceability versus identification. The websites tended to use the terms interchangeably often using the word identification as an umbrella term with little clarification as to the relationship with the act of tracking an animal through the supply chain. This may cause confusion when communicating with people to clarify what types of technology are best to use and why. One possibility to explore is that the term traceability may be less attractive because of activities it connotes, such as surveillance and liability. At this

point the researcher returns to the suggestion for the third phase of the research process described earlier in this chapter. This is an example of how such direct discussion will help to gain an understanding of the language of the producers within a certain culture of work. Currently differentiating between these two actions or processes consistently throughout the resources is difficult because they are so intertwined and yet not all identification types are effective traceable technology.

The researcher addresses the heterogeneity of the information management team's view of the audience and the degree to which that understanding will influence the performance. Nevertheless, the nature of these issues is such that while further understanding of why things are the way they are is needed, it does not change the level of current need and the disparities that often appear between need and equitable access. Further opportunities to research the information management perspective will be beneficial for understanding institutional barriers to implementing the suggestions and best practices as set forth in this analysis.

Final Thoughts

Issues of social complexity such as the state of beef cattle identification and traceability regulation in the US require a unique landscape of information resources that are applicable to the diverse body of individuals that need to understand the full scope of problems, possibilities, and avenues to solutions. Equitable access to information about the issue, as the research shows, is difficult to assess because of the contextual components of the producers and other stakeholders in combination with

both technological considerations and the presence of multiple types of risks. The research process identifies a path to analysis that allows for the preservation and illustration of complexity while still maintaining attention to studying levels of overall performance and uncovering specific gaps in both the information content and the container that delivers the resources.

For state and federal government officials the research offers a graphic birds-eye view of the information accessible in comparison with the demographic factors that will affect access. The tier-system and the network analysis demonstrate levels of performance in different types of access. One can see areas where improvements are necessary to fill in gaps and lessen vulnerabilities that occur when access to authoritative information is limited or is provided in such a way that it loses the trust of the seeker. The researcher provides the visualizations, ranking process, and checklist of necessary components as tools for officials to use in future analysis of the landscape of online information on this issue and as a template to tailor for use with other wicked problems.

For information and communication professionals the research offers the CIAV framework combining two information science theories into one complete package that drives the application of evaluation for equitable access of Internet materials that deal with the communication of information about multifaceted issues of social complexity. Future explorations might use this framework to look at other online resources in agricultural information science studies. This process might also be adapted to evaluate

resources in conjunction with other populations with suspected gaps between needs and access.

Finally it is the hope of this research to serve as a catalyst for a paradigm shift in the design of resources and resource interfaces for agricultural populations in the US. Similarly to the paradigm shift in the library science field in which digitization of processes and e-resources became the rule and not the exception and professionals were forced to adapt or lose their place, agricultural entities that provide information resources to producers in a network society will need to be proactive to meeting the needs of these individuals in new ways. Exploring the differences in electronic resource organization, beginning dialogues with the producers, and meeting the systemic needs related to this change are necessary in order to facilitate and maintain authority and trust with all those who seek online agricultural information.

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APPENDIX

A.1 Excerpt from APHIS ADT Final Ruling Announcement

Animal Disease Traceabililty

Last Modified: Feb 26, 2015 Print

On January 9, 2013, the U.S. Department of Agriculture (USDA) published a final rule establishing general regulations for improving the traceability of U.S. livestock moving interstate. The rule became effective on March 11, 2013.

"The United States now has a flexible, effective animal disease traceability system for livestock moving interstate, without undue burdens for ranchers and U.S. livestock businesses," said Agriculture Secretary Tom Vilsack. "The final rule meets the diverse needs of the countryside where states and tribes can develop systems for tracking animals that work best for them and their producers, while addressing gaps in our overall disease response efforts. Over the past several years, USDA has listened carefully to America's farmers and ranchers, working collaboratively to establish a system of tools and safeguards that will help us target when and where animal diseases occur, and help us respond quickly."

Under the final rule, unless specifically exempted, livestock moved interstate would have to be officially identified and accompanied by an interstate certificate of veterinary inspection or other documentation, such as owner-shipper statements or brand certificates.

After considering the public comments received, the final rule has several differences from the proposed rule issued in August 2011. These include:

- Accepting the use of brands, tattoos and brand registration as official identification when accepted by the shipping and receiving States or Tribes
- Permanently maintaining the use of backtags as an alternative to official eartags for cattle and bison moved directly to slaughter
- Accepting movement documentation other than an Interstate Certificate of Veterinary Inspection (ICVI) for all ages and classes of cattle when accepted by the shipping and receiving States or Tribes
- Clarifying that all livestock moved interstate to a custom slaughter facility are exempt from the regulations
- Exempting chicks moved interstate from a hatchery from the official identification requirements

Beef cattle under 18 months of age, unless they are moved interstate for shows, exhibitions, rodeos, or recreational events, are exempt from the official identification requirement in this rule. These specific traceability requirements for this group will be addressed in separate rulemaking, allowing APHIS to work closely with industry to ensure the effective implementation of the identification requirements.

A.2 Codebook Definitions of the Content Analysis Units

Construct	Definition
Topics	Subject matter of the information resource – may include more than one of the following topics:
Guidelines and regulations	Discuss state or federal rules and/or best practices regarding identification and/or traceability
	Discusses state rules regarding identification and/or traceability
	Discusses federal rules regarding identification and/or traceability
	Discusses best practices regarding identification and/or traceability
	Discusses legal Consequences of non-compliance
Programs, Events, and Opportunities	Talk about an upcoming or past occasion for participation and the aim or purpose of the organizing body.
	Talks about an upcoming occasion for participation.
	Talks about a past occasion for participation.
	Talks about institutional purpose or mission
How-tos and Instructions	Fact sheets, FAQs and explanations about the identification process
	Fact sheet about the identification process
	FAQs about the identification and traceability (needs Q&A format)
	Instructions about the process - gives directions
	4-H/ Youth Educational Resource
News stories	Discussion of current happenings other than programs and opportunities or research
	Discussion of current happening (other than programs and opportunities or research) - Local news
	Discussion of current happening (other than programs and opportunities or research) - National news
	Discussion of current happening (other than programs and opportunities or research) - International news
	Discussion of current happening - Editorial
	Discussion of current happening - Interview
	Historical Accounts
Discussing types of technology, methods of identification	Reviews the current ways that identification and traceability are executed.
	Explains current ways that identification (only) is executed
	Explains current ways that traceability is executed
	Discusses technology used for identification (only)
	Discusses technology used for traceability
Research	Explains the details and/or results from a scholarly study – could be the article.
	Explains the details from a scholarly study
	Explains the results (only) from a scholarly study

	Explains where to get data from a scholarly study
	Explains how to use data from a scholarly study
Economic and financial considerations	Focuses on issues related to market benefit and/or affordability of implementation – ex: price comparisons
	Focuses on issues related to market benefit from implementing
	Focuses on issues of market risk from not implementing
	Focuses on issues of personal financial gain related to implementation
	Focuses on issues related to personal financial risk or liability related to implementation
	Focuses on issues related to affordability of implementation
Basic information/ overview of concept	Introduces the idea of identification and/or traceability – the “What” and the “Why”
	Introduces the idea of identification (only) – the “What”
	Introduces the idea of traceability – the “What”
	Introduces the rationale behind identification (only) -the "Why"
	Introduces the rationale behind traceability-the "Why"
Dispelling myths and misinformation	Specifically addresses and explains common misconceptions about the issue.
	Addresses common misconceptions
	Provides evidence to counter misconceptions
Food Security: agroterrorism, disease outbreak, risk mitigation	The discussion is specifically related to the concept of biosecurity and the risk or prevention of disease including agroterrorism.
	The discussion is related to national biosecurity measures.
	The discussion is related to operation based biosecurity measures.
	The discussion is related to types of agroterrorism
	The discussion is related to the risks for agroterrorism.
	The discussion is related to the detection/ prevention of agroterrorism.
	The discussion is related to the prevention/detection of a disease outbreak (without mention of agroterrorism)
	The discussion is related to the consequences of a disease outbreak or attack.
	The discussion is specifically related to emergency response measures following an outbreak or attack
	The discussion is related to privacy of data and information related to operations
Unrelated	
(these were not included in the results reported and were strictly for note-taking purposes)	Not related in any way to the search terms.
	only partially relevant
	Other: Explain in Process Notes

Construct	Definition
Types (DCMI, 2014)	The function of the resource – there is potential for more than one type per resource.
Collection	An aggregation of resources
Dataset	Data encoded in a defined structure
Event	A persistent, time-based occurrence
Image	A visual representation other than text
Interactive resource	A resource requiring interaction from the user to be understood, executed, or experienced
Moving Image	A series of visual representations imparting an impression of motion when shown in succession
Service	A system that provides one or more functions
Software	A computer program in source or compiled form
Sound	A resource primarily intended to be heard
Still Image	A static visual representation (not photo)
Text	A resource consisting primarily of words for reading

Construct	Definition
Formats	The vehicle for the resource – reflected by file type. There is only one per resource. All formats listed and defined at: at http://www.zamzar.com/fileformats/ List the format underneath the record number - must be one of the listed ones on the website
	HTML
	PDF
	RTF
	PPT
	PPTX
	DOC
	DOCX
	XLS
	XLSX
	TXT
	ASCII

Construct	Definition
Information Quality	The following definition of terms compiled define elements of information quality
Accuracy	
	The content is free of known errors
	The content is free of misinformation
	The content is integral in providing the information that the title or the link promised

Currency	
	The information has no broken links.
	The information was updated within the past 2 years (2012)
	The content contains no information about canceled programs or projects
Source Authority	
	Authorship is disclosed
	Contact information is readily available
	Institutional affiliation is cited
Usability and Design	Checklist of ten criteria as defined by Jakob Nielsen (2009)
	A simple search field exists on the page
	A PDF is reserved for a manual or large document
	Visited links change color
	The text is written for online reading and supports scan-ability
	The font size is not fixed or too small
	The page titles are descriptive and short
	There is no animation, advertisements, or pop-ups
	The design is consistent with other resources and web sites
	The links work as simple hypertext reference; no new windows open
	Answers and main ideas are visible as such

Interactivity	Potential means for two-way flow of information between the cattle producer and the source of the dissemination.
	Resource offers user support (such as help, chat, email us function)
	Resource has advanced or customized search options
	Resource has open comment fields
	Resource offers interactive media or applications for wireless devices
	Resource offers folksonomy or tagging capability
	Resource offers a web 2.0 component (e.g.: share on Facebook)
	Resource endorses a participation program (must also be checked above in topics)
	Resource contains specific requests for user input

Relevance	Measure of how well the retrieved content aligns with the search query
0	Not relevant
0.5	Partial relevance
1	Relevant

A.3 Codebook Definitions and Guidelines Which Govern the Analysis Process

Area Classification	Guideline/Definition/Specification
Information on the homepage	The researcher makes a list of these links and evaluates them as one would any other retrieved document with relevance included (although – if the resource then appears in the search portion – the researcher will only evaluate it once- but will keep the note that it was displayed on the front page too.)
	When the homepage displays links to information that is visibly related to the search terms – the researcher makes a PDF of the first link only and saves it as StateAbbr_Source_Front#_Date.
Search process Specification	When there is ever a notice that results have been omitted because they are duplicates, the researcher checks to make sure that there are not others omitted by clicking the link provided - if they are indeed duplicate records, the researcher uses the initial returned results.
	In the instance that a record links back to the front home page the researcher will treat it as an original resource record the first time it shows up. The second or anytime thereafter it will be treated as a duplicate and skipped with a notation.
Content/Hyperlink specification	When the resource is an academic paper the researcher will not include any reference links in the analysis: these are considered in the same way as side bar links. Only the in text links will be included
Information Type Specification	Differentiation between program for participation and news: import and export are news about regulations - not participation.
Information Format Specifications	In order for a PDF to be considered as reserved for a large document or a manual the resource must be greater than 1 page in length.
	Amendment for one piece of the format definitions – the website Zamzar lists multiple types of HTML: namely HTML 4 and 5. It is difficult to differentiate that specifically for a site – HTML 4 and 5 are merged use HTML as one format.
Information Quality specifications	One of the quality measures asked about whether contact information is readily available. Readily available for this case is defined as being able to be seen without searching in tabs – a good example is in the case of Illinois DOAG where the contact us is an information link under the about us tab. Had the contact link been a tab – it would be counted as readily available.
	When there is an error in the searching process for a specific resource, the researcher will account for that when answering the information quality question – The content is free of known errors.
Interactivity Specification	When there is a map on the page that is linked to Google Maps - considering this to be an advanced/ customized search option.
Relevance Specification	Relevancy of dairy cattle identification: count it as "1" – the resources are often things that could potentially apply to beef cattle as well and there is a lot of cross over in the resources at stake should a disease outbreak occur.

A.4 Codebook Components of the Demographic Statistic Profile

Demographic Variable	Definition	File Access and Treatment	Notes
Total number of operations	This is the total number of operations per state that have a beef cattle herd. (Not exclusive)	Table 1 of the State Summary Highlights. Row = Beef Cows…Farms	
Operations with Internet connection	This is a total number for the state plus the breakdown of services by access type.	Quick Stats Ad-hoc Query Tool: Internet connection type by state listed for both NAICS categories 112111 and 112112. These were added together to get the total score for each type per state.	Service access types include: Broadband Over Power lines, Satellite, Cable Modem, Dial-up, DSL, Fiber-optic, and Mobile broadband
Experience Score	This is a score based on the sum of the average years of the primary operator on the farm and the average age of the primary operator.	Quick Stats Ad-hoc Query Tool: Retrieved both scores for 112111 and 112112 and averaged them for total average across the state before adding to get score.	Average age and average number of years were available in the same data set.
Total Economic Income from Beef cattle	This is a measure of the total amount of income for each state that comes from the production of beef cattle.	State Profile – Obtained for each state.	Amount is by (1000$) Use Value of Sales by Commodity Group: Cattle and Calves
Total State Income from Agriculture	This is a measure of the amount of income for the state that comes from agricultural operations in that state for the year.	Quick Stats Ad-hoc Query Tool: Total Sales by State	(When using with income from beef – not the discrepancy between the data reporting methods: this is not by 1000$ need to adjust)
Economic Rank	This is a measure that compares the states with all fifty states that is based on the total income for the state that comes from the production of beef cattle.	State Profile – obtained for each state.	Use Value of Sales by Commodity Group: Cattle and Calves
Economic Class of Farms	This breaks down the operations (Beef operations with Inventory) by their Economic class.	Quick Stats Ad-Hoc Query Tool: Beef operations with Inventory by economic class	There are 11 classes: < 1000; 1000-2499; 2500-4999; 5000-9999; 10000-24999; 25000-49999; 50000-99999; 100000-249999; 250000-499999; 500000-999999; 1000000 and <.
Number of Beef Cattle Farming and Ranching operations	This is the amount of operations in the state that classify as Beef Cattle Farming and Ranching operations.	Table 44: Farms by North American Classification System 112111	
Number of Feedlot operations	This is the amount of operations in the state that classify as Feedlot operations.	Table 44: Farms by North American Classification System 112112	

A.5 Codebook Definition for Perceived Degree of State Regulation

Perceived Degree of Regulation	Subjective Assessment Based on the Communicated Aspects of Regulation in the Resources Retrieved from Both State Web Sites
1	No visible discussion of regulations and no explicit guidelines or incentives
2	No visible discussion of regulations, but gives guidelines about the process of identification
3	Discussion of regulations, there could be voluntary programs but without explicit incentives or guidelines available
4	Discussion of regulations, voluntary traceability system with discussion of incentives and/or guidelines
5	All cattle premises must be registered within a state system

A.6 Sample Checklist for Web Evaluation of Basic Information Needs

Basic Information Need Item	Yes	No	Notes
All states should have information regarding guidelines and regulations.			
All states should have some relevant resources.			
All states should address the risk of foreign animal disease and biosecurity in some way.			
All states should provide more than one information format from the website.			
All states should have some accurate and current information.			
All states should have a search field or search box to look for specific information			
All states should have contact information available.			

A.7 Reference List of Information Resources on US Cattle Traceability

This list is not exhaustive, but represents a major portion of available information for US information seekers.

Corporate Publications/Resources

Beef Stocker USA RFID Survey
http://beefstockerusa.org/rfid/index-2.html

Cattle Management Blog by Cattle Soft
http://www.cattlemanagement.com/

Cattle Max Record Keeping
http://www.cattlemax.com/

CattleTags.com
http://www.cattletags.com/

Drover's Cattle Network
http://www.cattlenetwork.com/

Global Vet Link
https://www.globalvetlink.com/

Progressive Cattleman
http://www.progressivecattle.com/topics/management/3642-basic-principles-of-identifying-cattle

Sky King Ranch
http://skykingranch.com/newpage4.htm

Federal Information Resources

Animal Health Network
http://animalhealthnetwork.org/

APHIS Animal Disease Traceability
http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/animalhealth?1dmy&urile=wcm%3apath%3a%2FAPHIS_Content_Library%2FSA_Our_Focus%2FSA_Animal_Health%2FSA_Traceability

APHIS Import/Export
http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/importexport

Extension Disaster Education Network (EDEN)

http://eden.lsu.edu/Pages/default.aspx

Institute for Infectious Animal Disease (IIAD) –Department of Homeland Security
http://iiad.tamu.edu/

REEIS Search Results for Cattle Traceability: 243 Total results in 82 Projects
http://portal.nifa.usda.gov/enterprise-search/?site=CRIS_FACETS&client=reeis_facet&output=xml_no_dtd&proxystylesheet=reeis_facet&filter=0&getfields=Progress+Year.Knowledge+Area.Science.Subject.Type.Keywords.FDC.State.Grantee+Type.Project+Type.Sponsoring+Agency.Award+Amount+Range.Grant+Award+Year&q=cattle+traceability&btnG.x=20&btnG.y=6

USDA Blog – An Update on the Animal Disease Traceability Framework
http://blogs.usda.gov/2011/07/27/an-update-on-the-animal-disease-traceability-framework/

USDA Food Safety and Inspection Service (FSIS)
http://www.fsis.usda.gov/wps/portal/fsis/home

USDA ERS - Traceability in the U.S. Food Supply: Economic Theory and Industry Studies
http://www.ers.usda.gov/publications/aer-agricultural-economic-report/aer830.aspx

International Associations

Center for Food Security and Public Health
http://www.cfsph.iastate.edu/Species/bovine.php

International HACCP Alliance
http://www.haccpalliance.org/sub/index.html

International Livestock Identification Association (ILIA)
http://www.internationallivestockid.com/

ISO Standard Catalog Entry for Traceability
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=36297

OIE World Animal Health Information Database (WAHID)
http://www.oie.int/wahis_2/public/wahid.php/Wahidhome/Home

National Associations

American Association of Bovine Practitioners (AABP)
http://www.aabp.org/

American Veterinary Medical Association (AVMA)

https://www.avma.org/KB/Policies/Pages/AVMA-Position-on-Livestock-Identification.aspx

Beef Improvement Federation
http://beefimprovement.org/

Livestock Marketing Information Center (LMIC)
http://www.lmic.info/

National Cattlemen's Beef Association (NCBA)
http://www.beefusa.org/

National Farm Animal Identification and Records
http://www.nationalfair.com/

National Livestock Producers Association (NLPA)
http://www.nlpa.org/

National Institute for Animal Agriculture
http://www.animalagriculture.org/

North American Meat Institute (NAMI) focuses on the end of the supply chain
https://www.meatinstitute.org/

R-Calf USA
http://www.r-calfusa.com/animal-identification/

Samuel Roberts Noble Foundation
http://www.noble.org/ag/livestock/cattle-id-future/

US Animal Health Association (USAHA)
http://www.usaha.org/Home.aspx

State Associations
(There are many more state associations, too many to list. These associations are representative of what exists for many states.)

Arkansas Cattlemen's Association
http://www.arbeef.org/

California Premises and Animal Identification System
http://www.californiaid.org/

Indiana Beef Council
http://www.indianabeef.org/

New Hampshire Disaster Animal Response Team
http://www.newhampshiredart.org/

North Dakota Stockman's Association
http://www.ndstockmen.org/

South Eastern Missouri Beef Cattle Improvement Association
http://www.semobeef.com/home.html

Wisconsin Agro-security Resource Network (WARN)
http://www.wisconsinagroresource.net/

Wisconsin Livestock Identification Consortium (WLIC)
http://www.wiid.org/wisconsin-livestock-identification-consortium-home

VITA

Reid Isaac Boehm earned his master's degree in information science from the School of Information Science at the University of Tennessee in 2012. He earned his bachelor's degree in Ceramic Arts from the Maryland Institute College of Art in Baltimore, MD. His Master's thesis: *The information landscape of a wicked problem: an evaluation of web-based information on colony collapse disorder for a spectrum of citizen information seekers,* was awarded best thesis by the School of Information Sciences in 2013.

Reid's research interests focus on issues related to transdisciplinary study and scholarly collaboration to facilitate dialogue in application to socially complex or wicked problems. These interests are focused on Earth science, agricultural information and communication, and government resources. In particular, he is interested in facilitating sharing of data and information in equitable ways across multiple groups of individuals.

Reid has experience as a data center intern at the Oak Ridge National Laboratory's Distributed Active Archive Center for Biogeochemical Dynamics and as a student fellow for the Federation of Earth Science Information Partners (ESIP). Reid looks forward to working in data curation as an information professional in the future. In his spare time, he likes to hike, participate in Crossfit, practice yoga, read, and play with his dog.